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CINCINNATI, OHIO 45221

(NASA-CR-169159) FLAP-LAG-TORSIONAL
DYNAMICS OF EXTENSIONAL AND INEXTENSIONAL
ROTOR BLADES IN HOVER AND IN FORWARD FLIGHT
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SEMI-ANNUAL PROGRESS REPORT
JAN-JUNE 1982

NASA GRANT NAG 2-38



PRINCIPAL INVESTIGATOR: M.R.M. CRESPO DA SILVA
PROFESSOR

NASA TECHNICAL OFFICER FOR THIS GRANT:

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MOFFETT FIELD, CALIFORNIA
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The reduction of the $O(\epsilon^3)$ integro differential equations derived in [1] to ordinary differential equations using a set of orthogonal functions was described in [2]. Attention was focused on the hover flight condition.

Since the writing of [2], we have also decided to evaluate the set of Galerkin integrals that appear in the reduced equations by making use of nonrotating beam modes. Although a large amount of computer time was needed to accomplish this task, the Galerkin integrals so evaluated were stored on tape on a permanent basis for future use. Several of the coefficients were also obtained in closed form in order to check the accuracy of the numerical computations.

The equilibrium solution to the set of $3n$ equations obtained as described in [2] was determined as the solution to a minimization problem as follows. Let the $3n$ equilibrium equations be written in general form as

$$f_{vi}(x_1, x_2, \dots, x_m) = 0 \quad (1)$$

$$f_{wi}(x_1, x_2, \dots, x_m) = 0 \quad (2)$$

$$f_{\theta i}(x_1, x_2, \dots, x_m) = 0 \quad (3)$$

for $i = 1, 2, \dots, n$. Here $[x_1, x_2, \dots, x_m]$ denote the components of the vector of equilibrium deflections

$$[v_{e1}, v_{e2}, \dots; w_{e1}, w_{e2}, \dots; \theta_{e1}, \theta_{e2}, \dots, \theta_{en}].$$

When non-rotating normal modes are used, the boundary conditions at $x = 0$ are automatically satisfied and, thus, $m = 3n$. When Legendre polynomials are used, satisfaction of the boundary conditions at $x = 0$ require four constraint equations to be satisfied (two for the lead-lag deflections and two for the flap deflections), and the

number of unconstrained variables in equations (1) to (3) is then
 $m = 3n - 4$.

The solution to the equations was obtained by finding the vector $[x_1, x_2, \dots, x_k]$ that minimizes the function

$$f \triangleq \sum_{i=1}^n (f_{vi}^2 + f_{wi}^2 + f_{\theta i}^2) \quad (4)$$

A listing of the computer program written to solve this problem is included in this report. The Galerkin coefficients (using either non-rotating normal modes or Legendre coefficients) were read from the appropriate files of the tape where they were stored. A copy of the computer programs written to evaluate the Galerkin coefficients are also included here (programs COEFFFREE, where non-rotating normal modes were used, and COEFFPOL, where Legendre polynomials were used).

The vector $\underline{x} \triangleq [x_1, x_2, \dots, x_m]$, corresponding to the minimum of f , was obtained by making use of "standard" subroutine packages. Convergence problems when using the IMSL package ZXMIN were encountered for a number of the cases tried. The IBM SSP packages DFMCG and DFMFP have given the "best" results so far. They are the ones being used in the program listings enclosed. For several of the test cases, one of these packages take f to about 10^{-8} . It was observed that when the vector \underline{x} , corresponding to such value of f , is used as an initial "guess" for the other package, the value of f is then decreased to about 10^{-20} . The tip deflections were then calculated and found to agree well with test cases taken from [3].

In order to use the above subroutine packages, the gradient components of f needed to be determined. Two different approaches were used to determine them, and both were programmed in the enclosed listings. One such approach, which may present numerical difficulties

for some cases, was to approximate $\partial f / \partial x_j$ ($j = 1, 2, \dots, k$) as

$$\partial f / \partial x_j = [f(x_1, \dots, x_j - \Delta, \dots, x_m) - f(x_1, \dots, x_j + \Delta, \dots, x_m)] / 2(\Delta)$$

for a sufficiently small value of Δ . The other approach was to use an analytical expression for $\partial f / \partial x_j$.

The functions f_{vi} , f_{wi} and $f_{\theta i}$ are of the following form, with summation in j and k implied:

$$\begin{aligned} f_{\alpha i} = & (VJ)_j v_{ej} + (WJ)_j w_{ej} + (TJ)_j \theta_{ej} \\ & + v_{ej} [(VV)_{jk} v_{ek} + (VW)_{jk} w_{ek} + (VT)_{jk} \theta_{ek}] \\ & + w_{ej} [(WW)_{jk} w_{ek} + (WT)_{jk} \theta_{ek}] + (TT)_{jk} \theta_{ej} \theta_{ek} \\ & + v_{ej} v_{ek} [(VVV)_{jkl} v_{eL} + (VWV)_{jkl} w_{eL} + (VVT)_{jkl} \theta_{eL}] \\ & + v_{ej} v_{ek} [(VWW)_{jkl} w_{eL} + (VWT)_{jkl} \theta_{eL}] \\ & + w_{ej} w_{ek} [(WWW)_{jkl} w_{eL} + (WWT)_{jkl} \theta_{eL}] \\ & + [(VTT)_{jkl} v_{ej} + (WTT)_{jkl} w_{ej} + (TTT)_{jkl} \theta_{ej}] \theta_{ek} \theta_{eL} \quad (5) \end{aligned}$$

(for $\alpha = v, w, \theta$), where $(VJ)_j$, $(VV)_{jk}$, etc., denote the respective coefficients of the terms v_{ej} , $v_{ej} v_{ek}$, etc. These coefficients are functions of the Galerkin coefficients, of problem parameters such as collective pitch and pre-cone angle, and of the inflow ratio λ . These coefficients would be independent of the elastic deflections if λ were not dependent on these same deflections. For these cases, $\partial f_{\alpha i} / \partial x_j$ would have a relatively simple form that can be easily expressed in algorithm form. For example,

$$\begin{aligned}
\partial f_{ai} / \partial v_{ej} = & (VJ)_j + [(VV)_{jk} + (VV)_{kj}] v_{ek} + (VW)_{jk} w_{ek} + (VT)_{jk} \theta_{ek} \\
& + [(VVV)_{jkl} + (VVV)_{kjl} + (VVV)_{lkj}] v_{ek} v_{el} + [(VWV)_{jkl} \\
& + (VWV)_{kjl}] v_{ek} w_{el} + [(VVT)_{jkl} + (VVT)_{kjl}] v_{ek} \theta_{el} \\
& + w_{ek} [(VWW)_{jkl} w_{el} + (VWT)_{jkl} \theta_{el}] + (VTT)_{jkl} \theta_{ek} \theta_{el}
\end{aligned}
\tag{6}$$

The algorithm developed on the basis of such expressions was incorporated in the subroutine used by the minimization package. The statements corresponding to this algorithm were included in subroutine FUNCTIN as "comment statements C," which can be converted to executable statements when appropriate. The program developed can also be useful on a study of the influence of the inflow modelling on the blade dynamics.

REFERENCES

1. Crespo da Silva, M.R.M., "Flap-Lag-Torsional Dynamic Modelling of Rotor Blades in Hover and in Forward Flight, Including the Effect of Cubic Non-linearities." NASA CR-166194, July 1981.
2. Crespo da Silva, M.R.M., "Semi-Annual Progress Report, July-December 1981, NASA grant NAG 2-38.
3. Hodges, D.H. and Ormiston, R.A., "Stability of Elastic Bending and Torsion of Uniform Cantilever Rotor Blades in Hover with Variable Structural Coupling." NASA TN D-8192, April 1976.

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1. //XXXXXXXXL JOB (0,XXXXXX), 'CRESPO', TIME=(0,44)
2. /*JOBPARM LINES=200
3. /*ROUTE PRINT RMT41
4. //STEP1 EXEC FORTGCLG, REGION=(256K,768K)
5. //FORT.SYSIN DD *
6.     CALL HOVER(0,0.05D0,0.05D0,1,0.0D0,0.1D0,1)
7.     STOP
8.     END
9.     SUBROUTINE HOVER(ILGDRE,BETAL,DBETA,NBETA,THETAL,DTHETA,NTHETA)
10. C *****
11. C *
12. C * PROGRAM TO DETERMINE THE EQUILIBRIUM DEFLECTIONS
13. C * OF A ROTOR BLADE IN HOVER
14. C *
15. C * ILGDRE=0 IF NON-ROTATING NORMAL MODES ARE USED
16. C * ILGDRE=1 IF LEGENDRE POLYNOMIALS ARE USED
17. C *
18. C *****
19.     IMPLICIT REAL*8(A-H,O-Z)
20.     INTEGER EPS2, EPS3, EPS3JB
21.     DIMENSION X(24), GRAD(24), W(60), FI(8), ALPHA(8), BBETA(8), XG(8),
22.     1U(8,8), U1(8,8), FSQ(10,10,10), IER(10,10,10)
23.     DIMENSION DELTA(8,8), A(8), B(8), C(8), D(8,8), E(8,8), F(8,8,8), G(8,8,8)
24.     1), H(8,8,8), XI(8,8), XJ(8,8), XK(8,8,8), XM(8,8), XN(8,8), O(8,8), P(8,8)
25.     2), Q(8), R(8,8), S(8), A3(8,8,8), B3(8,8,8,8), C3(8,8,8,8), D3(8,8,8)
26.     3E3(8,8,8,8), F3(8,8,8,8), G3(8,8,8,8), H3(8,8,8,8), XI3(8,8,8,8), XJ3(8,8,8)
27.     4XK3(8,8), XL3(8,8), XM3(8,8), XN3(8,8), O3(8,8,8), P3(8,8,8), Q3(8,8,8)
28.     5), R3(8,8,8,8), S3(8,8,8,8), T3(8,8,8), DEL(8,8), DELF(8,8)
29.     DIMENSION U3(8,8,8), V3(8,8,8), W3(8,8,8), X3(8,8,8), Y3(8,8,8), Z3(8,8,8)
30.     1), A4(8,8,8,8), B4(8,8,8,8), C4(8,8,8,8), D4(8,8,8,8), E4(8,8,8,8)
31.     2F4(8,8,8,8), G4(8,8,8,8), H4(8,8,8,8), XI4(8,8,8,8), XJ4(8,8,8,8), XK4(8,8,8)
32.     3XL4(8,8,8,8), XM4(8,8,8,8), XN4(8,8,8,8), O4(8,8,8,8), P4(8,8,8,8), Q4(8,8,8,8)
33.     4R4(8,8,8,8), S4(8,8,8,8), T4(8,8,8,8), U4(8,8,8,8), V4(8,8,8,8), W4(8,8,8,8), X41(8,8)
34.     5, VETIP(8,4,6), WETIP(8,4,6), THETIP(8,4,6), PHIE(8,4,6)
35.     COMMON/VAR1/ EPS2, EPS3, EPS3JB, NFUNCT, NF
36.     COMMON/VAR2/ X1, X2, X3, X4, X5, X6, X7, X8, X9, X10, X11, X12, X13, X14, X15,
37.     1X16, X17, X18, X19, X20, X21, X22, X23, X24, X25, X26, X27, X28, X29, X30, X31,
38.     2X32, X33, X34, X35, X36, X37, X38, X39, X40, X41, Y1, Y2, Y3, Y4, Y5, Y6, Y7, Y8,
39.     3Y9, Y10, Y11, Y12, Y13, Y14, Y15, Y16, Y17, Y18, Y19, Y20, Y21, Y22, Y23, Y24, Z1,
40.     4Z2, Z3, Z4, Z5, Z7, A11, A12, A21, A22, DCSI, CHORD, SINB, COSB, S2B, C2B, SBCB,
41.     5COSPC, C2BOEA, SQRT2, S3C, SCCC, COS2C, SIN2C, VEN1, VEN, WEN1, WEN, THETAC
42.     COMMON/VAR3/ CDOOPI, SINPC, C2C, S2C, DEL, DELF, DELTA, A, B, C, D, E, F, G, H, XI
43.     1, XJ, XK, XM, XN, O, P, Q, R, S, A3, B3, C3, D3, E3, F3, G3, H3, XI3, XJ3, XK3, XL3, XM3
44.     2, XN3, O3, P3, Q3, R3, S3, T3, U3, V3, W3, X3, Y3, Z3, A4, B4, C4, D4, E4, F4, G4, H4,
45.     3XI4, XJ4, XK4, XL4, XM4, XN4, O4, P4, Q4, R4, S4, T4, U4, V4, W4, FI1
46.     COMMON/VAR5/ SIGMA, XG, U
47.     EXTERNAL FUNCTB, FUNCTL
48.     29 FORMAT(' *****')
49.     30 FORMAT(' ***** PRE-CONE ANGLE : BETA= ', D14.7)
50.     31 FORMAT(' COLLECTIVE PITCH : THETAC= ', D14.7)
51.     32 FORMAT(' NFUNCT VE(X=1) WE(X=1) THETA(X=1)')
52.     1 PHIE(X=1), '9X, 'FSQ', 10X, 'IER')
53.     33 FORMAT(' ', 11, 5(3X, D14.7), 3X, I2)
54.     CALL UNDFLW
55. C ***** INPUT DATA *****
56.     PI=3.141592654D0
57.     DETA=0.0146D0
58.     DZETA=0.1654D0
59. C
60.     DCSI=0.00089D0
61.     DCSI=0.0056D0
62.     EICSI=DETA+DZETA
63.     XJETA=0.0D0
64.     XJZETA=0.000625D0
65.     XJCSI=XJETA+XJZETA
66.     EA=128.0D0
67.     GAMA=5.0D0
68.     SIGMA=0.1D0
69.     CHORD=PI/40
70.     CDO=0.01D0
71.     EPS2=1
72.     EPS3=1
73.     EPS3JB=1
74. C *****
75. C *
76. C * THE ROTOR INFLOW RATIO LAMBDA (DENOTED BY XLMBDA IN
77. C * THIS PROGRAM) IS CALCULATED EITHER IN FUNCTION
78. C * SUBPROGRAM FUNCTN (IF NON-ROTATING NORMAL MODES ARE
79. C * USED) OR IN FUNCTION SUBPROGRAM FUNCT (IF LEGENDRE

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80. C *
81. C * NFNCT IS THE NUMBER OF NON-ROTATING NORMAL MODES *
82. C * (OR LEGENDRE POLYNOMIALS) USED. *
83. C * *
84. C * NFNCT MUST BE AT LEAST 3 IF LEGENDRE POLYNOMIALS *
85. C * ARE USED. *
86. C *
87. C *****
88. C DO 400 I=1,8
89. C READ(50) A(I),B(I),C(I),Q(I),S(I),H4(I),U4(I)
90. C 400 CONTINUE
91. C DO 411 I=1,8
92. C DO 420 J=1,8
93. C READ(50) DEL(I,J),DELTA(I,J),D(I,J),E(I,J),XI(I,J),XJ(I,J)
94. C READ(50) XM(I,J),XN(I,J),O(I,J),P(I,J),R(I,J),D3(I,J)
95. C READ(50) G3(I,J),XJ3(I,J),XK3(I,J),XL3(I,J),XM3(I,J),W3(I,J)
96. C READ(50) XK4(I,J),XN4(I,J),Q4(I,J),T4(I,J)
97. C 420 CONTINUE
98. C 411 CONTINUE
99. C DO 430 I=1,8
100. C DO 440 J=1,8
101. C DO 450 K=1,8
102. C READ(50) F(I,J,K),G(I,J,K),H(I,J,K),XK(I,J,K),A3(I,J,K)
103. C 1,XN3(I,J,K)
104. C READ(50) Q3(I,J,K),P3(I,J,K),Q3(I,J,K),T3(I,J,K),U3(I,J,K)
105. C 1,V3(I,J,K)
106. C READ(50) X3(I,J,K),Y3(I,J,K),Z3(I,J,K),XJ4(I,J,K),XM4(I,J,K)
107. C 1,P4(I,J,K)
108. C READ(50) S4(I,J,K),W4(I,J,K)
109. C 450 CONTINUE
110. C 440 CONTINUE
111. C 430 CONTINUE
112. C DO 460 I=1,8
113. C DO 470 J=1,8
114. C DO 480 K=1,8
115. C DO 490 L=1,8
116. C READ(50) B3(I,J,K,L),C3(I,J,K,L),E3(I,J,K,L),F3(I,J,K,L)
117. C 1,H3(I,J,K,L),XI3(I,J,K,L)
118. C READ(50) R3(I,J,K,L),S3(I,J,K,L),A4(I,J,K,L),B4(I,J,K,L)
119. C 1,C4(I,J,K,L),D4(I,J,K,L)
120. C READ(50) E4(I,J,K,L),F4(I,J,K,L),G4(I,J,K,L),XI4(I,J,K,L)
121. C 1,XL4(I,J,K,L),Q4(I,J,K,L)
122. C READ(50) R4(I,J,K,L),V4(I,J,K,L)
123. C 490 CONTINUE
124. C 480 CONTINUE
125. C 470 CONTINUE
126. C 460 CONTINUE
127. C
128. C *****
129. C *
130. C * THE COEFFICIENTS DELF(I,J) *
131. C DO 500 I=1,8
132. C DO 501 J=1,8
133. C DELF(I,J)=DEL(I,J)
134. C IF(I.EQ.1.AND.ILGDRE.EQ.1) DELF(I,J)=0.DO
135. C 501 CONTINUE
136. C 500 CONTINUE
137. C *
138. C *****
139. C *
140. C * THE COEFFS. XG(I) TO CALCULATE THE INFLOW RATIO *
141. C XG(1)=1.30456294500
142. C XG(2)=-0.541196100100
143. C XG(3)=XG(2)
144. C XG(4)=XG(1)
145. C XG(5)=-XG(1)
146. C XG(6)=-XG(2)
147. C XG(7)=XG(6)
148. C XG(8)=XG(5)
149. C
150. C *****
151. C NMIN=3
152. C IF(ILGDRE.EQ.1) GO TO 1111
153. C NMIN=1
154. C *****
155. C *
156. C * THE COEFFICIENTS U1(I,J) AND U(I,J) TO CALCULATE *
157. C * THE EQUILIBRIUM ELASTIC DEFLECTION PHIE AT X=1 AND *
158. C * THE INFLOW RATIO, RESPECTIVELY, WHEN NON-ROTATING *
159. C * NORMAL MODES ARE USED *

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C *

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160. BBETA(1)=0.18751040687D1
161. BBETA(2)=0.46940911330D1
162. BBETA(3)=0.78547574382D1
163. BBETA(4)=0.10995540735D2
164. BBETA(5)=0.14137168391D2
165. BBETA(6)=0.17278759532D2
166. BBETA(7)=0.20420352251D2
167. BBETA(8)=0.23561944902D2
168. ALPHA(1)=0.73409551376D0
169. ALPHA(2)=0.10184673187D1
170. ALPHA(3)=0.99922449652D0
171. ALPHA(4)=0.10000335533D1
172. ALPHA(5)=0.99999855011D0
173. ALPHA(6)=0.10000000626D1
174. ALPHA(7)=0.99999999729D0
175. ALPHA(8)=1.D0
176. NI=1
177. DO 3111 I=1,8
178. AUX1=ALPHA(I)*BBETA(I)
179. U1(I,I)=2*AUX1**2
180. AUX2=BBETA(I)**2
181. AUX3=AUX2**2
182. NJ=1
183. DO 3112 J=1,8
184. IF(J.EQ.I) GO TO 3113
185. U1(I,J)=4*AUX1*AUX2*ALPHA(J)*BBETA(J)*(BBETA(J)**2-NI*NJ+AUX2)
186. U1(J,I)=4*AUX1*AUX2*ALPHA(J)*BBETA(J)*(BBETA(J)**2-NI*NJ+AUX2)
187. U1(J,J)=4*AUX1*AUX2*ALPHA(J)*BBETA(J)*(BBETA(J)**2-NI*NJ+AUX2)
188. 3113 NJ=-NJ
189. 3112 CONTINUE
190. NI=-NI
191. 3111 CONTINUE
192. U(1,1)=0.36292246D1
193. U(1,2)=0.5505781D1
194. U(1,3)=0.1744958D1
195. U(1,4)=0.2134544D1
196. U(1,5)=0.1564799D1
197. U(1,6)=0.3704012D0
198. U(1,7)=0.1934753D1
199. U(1,8)=0.8247060D-1
200. U(2,1)=-0.2647601D2
201. U(2,2)=0.3029180D2
202. U(2,3)=0.1014811D3
203. U(2,4)=0.2160570D2
204. U(2,5)=0.2871452D2
205. U(2,6)=0.4369674D2
206. U(2,7)=-0.6868077D1
207. U(2,8)=0.3987049D2
208. U(3,1)=0.1261884D2
209. U(3,2)=-0.1429789D3
210. U(3,3)=0.1421241D2
211. U(3,4)=0.4318519D3
212. U(3,5)=0.1174606D3
213. U(3,6)=0.3621580D2
214. U(3,7)=0.2377329D3
215. U(3,8)=-0.4042645D2
216. U(4,1)=0.1199459D2
217. U(4,2)=-0.6242567D2
218. U(4,3)=-0.4038911D3
219. U(4,4)=0.1375219D2
220. U(4,5)=0.9834033D3
221. U(4,6)=0.4199045D3
222. U(4,7)=0.1383665D2
223. U(4,8)=0.5320940D3
224. U(5,1)=-0.5021859D2
225. U(5,2)=0.1118483D3
226. U(5,3)=-0.2137421D3
227. U(5,4)=-0.1078111D4
228. U(5,5)=0.1630623D3
229. U(5,6)=0.1855181D4
230. U(5,7)=0.8054312D3
231. U(5,8)=0.1908673D3
232. U(6,1)=0.5983286D2
233. U(6,2)=-0.2176271D3
234. U(6,3)=-0.8292016D2
235. U(6,4)=-0.3027167D3
236. U(6,5)=-0.2258734D4
237. U(6,6)=0.2496686D3
238. U(6,7)=-0.3445334D4
239. U(6,8)=-0.1113894D4
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240.      U(7,1)=-0.3137553D2
241.      U(7,2)=-0.9192193D2
242.      U(7,3)=-0.2959916D3
243.      U(7,4)=-0.7115023D2
244.      U(7,5)=-0.6080909D3
245.      U(7,6)=-0.3689485D4
246.      U(7,7)=0.5970872D2
247.      U(7,8)=0.5750219D4
248.      U(8,1)=-0.3461307D2
249.      U(8,2)=0.5988959D2
250.      U(8,3)=-0.2790705D2
251.      U(8,4)=-0.5993094D3
252.      U(8,5)=0.4059256D4
253.      U(8,6)=-0.1400279D4
254.      U(8,7)=-0.5610158D4
255.      U(8,8)=0.8213839D2
256.      GO TO 1113
257. 1111 DO 2 I=1,8
258.      DO 3 J=1,8
259.      CALL FX41(X41(I,J),I,J)
260.      X41(J,I)=X41(I,J)
261.      3 CONTINUE
262.      2 CONTINUE
263.      DO 444 NI=1,8
264.      FI1(NI)=DSQRT(2.DO*NI-1.DO)
265. 444 CONTINUE
266. C
267. C *****
268. C * THE COEFFICIENTS U1(I,J) AND U(I,J) WHEN LEGENDRE *
269. C * POLYNOMIALS ARE USED *
270. C *
271. C
272.      DO 1001 I=3,8
273.      DO 1002 J=2,8
274.      CALL FUUI(U1(I,J),U(I,J),I,J)
275. 1002 CONTINUE
276.      U1(I,1)=0.DO
277.      U(I,1)=0.DO
278. 1001 CONTINUE
279.      DO 1003 J=1,8
280.      U1(1,J)=0.DO
281.      U(1,J)=0.DO
282.      U1(2,J)=0.DO
283.      U(2,J)=0.DO
284. 1003 CONTINUE
285. C *
286. C *****
287. 1113 SQRT2=DSQRT(2.DO)
288.      CDOOPI=EPS2*CDO/(2.DO*PI)
289.      Z7=DETA-DZETA
290.      DO 4 IBETA=1,NBETA
291.      BETA=BETAL+DBETA*(IBETA-1)
292.      WRITE(6,29) BETA
293.      WRITE(6,30) BETA
294.      COSB=DCOS(BETA)
295.      SINB=DSIN(BETA)
296.      S2B=SINB**2
297.      C2B=COSB**2
298.      C2BOEA=EPS3*C2B/EA
299.      Z4=EICSI*C2BOEA
300.      SBCB=SINB*COSB
301.      X1=GANA*COSB/6.DO
302.      X9=CHORD*COSB/2
303.      X15=C2BOEA*C2B/4
304.      X16=EPS2*X1*SINB
305.      X29=X1*COSB
306.      DO 5 ITHETA=1,NTHETA
307.      THETAC=THETAL+DTHETA*(ITHETA-1)
308.      WRITE(6,31) THETAC
309.      WRITE(6,32)
310.      COSPC=DCOS(THETAC)
311.      SINPC=DSIN(THETAC)
312.      SCCC=SINPC*COSPC
313.      C2C=COSPC**2
314.      S2C=1-C2C
315.      S3C=S2C*SINPC
316.      COS2C=2*C2C-1
317.      SIN2C=2*SCCC
318. C**      X2=XLMBDA*(EPS2*XLMBDA*COSB*COSPC-EPS3*CHORD*SINB/2)
319. C**      XX3=XLMBDA*C2B*SINPC*(1+EPS3*CDOOPI*C2C)

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320. X4=CDOOFI#COSB#COSPC
321. X5=EPS3JB*(XJETA-XJZETA)*SCC#SBCB
322. X7=-77*SCC
323. X10=SINPC#SINB
324. X11=X10#C2C
325. X12=DETA#S2C#DZETA#C2C
326. X14=X12#C2BOEA
327. C** X17=EPS3*XLMBDA#S2C#COSPC
328. C** X18=EPS3*XLMBDA#SINPC
329. X20=EPS3*2#CDOOFI#COSB#SINPC#C2C
330. X21=EPS3#CHORD#SINB#S2C/2
331. X22=C2BOEA#COSB#SINPC#COS2C/2
332. X38=1+2#S2C
333. X23=EPS3*X16*X38#COSPC
334. X24=-77#COS2C
335. X25=EPS3*X1#SINPC
336. X26=SINB#COS2C
337. X27=X9#SINPC
338. C** X29=EPS3*XLMBDA#COSPC
339. X31=X28#SINPC
340. X33=2#C2C
341. C** X34=EPS3*XLMBDA*(C2C-3#S2C)
342. X36=C2C-S2C/2
343. X37=X28#COSPC
344. X39=X31*(2#C2C/3-S2C/2)
345. X40=C2B#SINPC#COS2C/2
346. Y1=XJETA#S2C+XJZETA#C2C-XJCSI
347. C** Y2=SBCB+X37*XLMBDA+X1#CDOOFI#X30#COSB-X16#CHORD/2
348. YY3=EPS3JB*Y1#SBCB
349. C** Y4=C2BOEA*(SBCB+X37*XLMBDA)/2
350. Y5=EPS2*X31#C2B/EA
351. Y6=DETA#C2C#DZETA#S2C
352. Y7=-EPS3JB*Y1#C2B
353. Y10=EPS2*2#X10
354. Y11=X16#COSPC
355. C** Y12=XLMBDA#SCC
356. Y13=(1+EPS3*2#CDOOFI#S2C)*COSB#COSPC
357. Y15=C2BOEA#COSB#COSPC#C2C
358. Y16=EPS3*2#Y11#COSPC#S2C
359. Y17=EPS3*X1#COSPC
360. Y18=2#SINB#C2C
361. Y19=SINPC#C2C/2
362. Y22=(1-C2C/3+S2C)/2
363. Y23=C2B#C2C#COSPC
364. Y24=X37#C2C
365. Z1=EPS2*(XJZETA-XJETA)*C2B#SCC
366. Z2=EPS3#GAMA#COSPC*(CHORD**2)/96
367. Z5=Z2#C2B
368. Z2=Z2#SBCB
369. ZZ3=EPS3*(XJZETA-XJETA)*COS2C#C2B
370. DO 1 NFNCT=NMIN,5
371. NX=3#NFNCT
372. IF(ILGDRE.EQ.0) GO TO 1112
373. NX=NX-4
374. C *****
375. C
376. NA=-1
377. IF(NFNCT.EQ.3.OR.NFNCT.EQ.5.OR.NFNCT.EQ.7) NA=1
378. C NA=(-1)**(NFNCT+1)
379. A1=FI1(NFNCT)
380. A2=FI1(NFNCT-1)
381. A11=NA#NFNCT/(2#A2)
382. A12=NA/(2*(NFNCT-1)#A2)
383. A21=NA*(NFNCT-2)/(2#A1)
384. A22=NA/(2*(NFNCT-1)#A1)
385. C** A11,A12,A21,A22 ARE USED IN SUBROUTINE FUNCT TO CALCULATE
386. C** VE(NFNCT-1),VE(NFNCT),WE(NFNCT-1) AND WE(NFNCT)
387. C
388. C *****
389. C THE VECTOR X(I) USED IN THE OPTIMIZATION ROUTINE IS DEFINED AS
390. C [X(1),X(2),...X(3#NFNCT-4)] =
391. C [VE(1),VE(2),...,VE(NFNCT-2);WE(1),WE(2),...,WE(NFNCT-2);
392. C THETA(1),THETA(2),...,THETA(NFNCT)1.
393. C ** NOTE THAT VE(NFNCT-1),VE(NFNCT),WE(NFNCT-1) AND WE(NFNCT)
394. C ARE CALCULATED SO THAT THE CANTILEVER BOUNDARY CONDITIONS AT X=0
395. C ARE SATISFIED. THESE QUANTITIES, DENOTED HERE IN THE PROGRAM BY
396. C VEN1,VEN,WEN1 AND WEN, RESPECTIVELY, ARE CALCULATED IN THE
397. C SUBROUTINE FUNCT AND RETURNED AS A COMMON VARIABLE TO THIS
398. C PART OF THE PROGRAM.
399. C ** INITIAL GUESS FOR THE VECTOR X(I) *****

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400. 1112 DO 6 K=1,NX
401. X(K)=0.DO
402. 6 CONTINUE
403. C *****
404. NUMBER=0
405. EST=0
406. EPS=1.D-6
407. LIMIT=500
408. IF(ILGDRE.EQ.1) GO TO 2111
409. 8000 CALL DFMCB(FUNCTB,NX,X,FSQ(IBETA,ITHETA,NFUNCT),GRAD,EST,EPS,LIMIT
410. 1,IER(IBETA,ITHETA,NFUNCT),W)
411. C IF(FSQ(IBETA,ITHETA,NFUNCT)).LE.1.D-20) GO TO 2112
412. NUMBER=NUMBER+1
413. IF(NUMBER.LT.1) GO TO 8000
414. CALL DFMCB(FUNCTB,NX,X,FSQ(IBETA,ITHETA,NFUNCT),GRAD,EST,EPS,
415. 1LIMIT,IER(IBETA,ITHETA,NFUNCT),W)
416. GO TO 2112
417. 2111 CALL DFMCB(FUNCTL,NX,X,FSQ(IBETA,ITHETA,NFUNCT),GRAD,EST,EPS,LIMIT
418. 1,IER(IBETA,ITHETA,NFUNCT),W)
419. C WRITE(6,*) NFUNCT,FSQ(IBETA,ITHETA,NFUNCT),IER(IBETA,ITHETA,NFUNCT)
420. C IT)
421. C DO 333 I=1,NX
422. C WRITE(6,*) X(I)
423. C 333 CONTINUE
424. GO TO 1114
425. C ** TIP DEFLECTIONS WHEN NON-ROTATING NORMAL MODES ARE USED **
426. 2112 VETIPA=0.DO
427. WETIPA=0.DO
428. THETPA=0.DO
429. NVE1=2*NFUNCT
430. NA=1
431. PHI=0.DO
432. DO 777 I=1,NFUNCT
433. VETIPA=VETIPA+2*NA*X(I)
434. WETIPA=WETIPA+2*NA*X(NFUNCT+I)
435. THETPA=THETPA+NA*X(NVE1+I)
436. DO 778 J=1,NFUNCT
437. AUX=U1(I,J)*X(NFUNCT+J)
438. 778 CONTINUE
439. PHI=PHI+AUX*X(I)
440. NA=-NA
441. 777 CONTINUE
442. VETIP(IBETA,ITHETA,NFUNCT)=VETIPA
443. WETIP(IBETA,ITHETA,NFUNCT)=WETIPA
444. THETPA=SQRT2*THETPA
445. THETIP(IBETA,ITHETA,NFUNCT)=THETPA
446. PHIE(IBETA,ITHETA,NFUNCT)=THETAC+THETPA+PHI
447. GO TO 3333
448. C
449. C *****
450. C * TIP DEFLECTIONS WHEN LEGENDRE POLYNOMIALS ARE USED *
451. C *
452. C *
453. C * VETIP=VE(1)+VE(2)*SQRT(3)+VE(3)*SQRT(5)+...
454. C * WETIP=WE(1)+WE(2)*SQRT(3)+WE(3)*SQRT(5)+...
455. C * THETAETIP=SQRT(2)*(THETA(1)-THETA(2)+THETA(3)-...)
456. C *
457. C *****
458. 1114 NN=NFUNCT-2
459. NVE1=2*NFUNCT
460. DO 7 I=1,NN
461. W(I)=X(I)
462. I1=NN+I
463. I2=NFUNCT+I
464. W(I2)=X(I1)
465. I1=NVE1-4
466. I2=NVE1+I
467. W(I2)=X(I1)
468. 7 CONTINUE
469. W(NFUNCT-1)=VEN1
470. W(NFUNCT)=VEN
471. W(NVE1-1)=WEN1
472. W(NVE1)=WEN
473. I1=3*NFUNCT
474. W(I1-1)=X(I1-5)
475. W(I1)=X(I1-4)
476. VETIPA=0.DO
477. WETIPA=0.DO
478. THETPA=0.DO
479. NA=1

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480. PHI=0.DO
481. DO 877 I=1,NFUNCT
482. I1=NFUNCT+I
483. I2=NVE1+I
484. VETIPA=VETIPA+FI1(I)*W(I)
485. WETIPA=WETIPA+FI1(I)*W(I1)
486. THETPA=THETPA+NA*W(I2)
487. DO 878 J=1,NFUNCT
488. I1=NFUNCT+J
489. AUX=U1(I,J)*W(I1)
490. 878 CONTINUE
491. PHI=PHI+AUX*W(I)
492. NA=-NA
493. 877 CONTINUE
494. VETIP(IBETA, ITHETA, NFUNCT)=VETIPA
495. WETIP(IBETA, ITHETA, NFUNCT)=WETIPA
496. THETPA=SQRT2*THETPA
497. THETIP(IBETA, ITHETA, NFUNCT)=THETPA
498. PHIE(IBETA, ITHETA, NFUNCT)=THETAC+THETPA+PHI
499. 3333 WRITE(6,33) NFUNCT, VETIP(IBETA, ITHETA, NFUNCT), WETIP(IBETA, ITHETA
500. 1, NFUNCT), THETIP(IBETA, ITHETA, NFUNCT), PHIE(IBETA, ITHETA, NFUNCT),
501. 2FSQ(IBETA, ITHETA, NFUNCT), IER(IBETA, ITHETA, NFUNCT)
502. WRITE(6,*)
503. 1 CONTINUE
504. 5 CONTINUE
505. 4 CONTINUE
506. WRITE(6,29)
507. RETURN
508. END
509. C *****
510. SUBROUTINE DDFMCG(FUNCTB, NX, X, FSQ, GRAD, EST, EPS, LIMIT, IER, W)
511. IMPLICIT REAL*8(A-H, O-Z)
512. INTEGER EPS2, EPS3, EPS3JB
513. DIMENSION X(24), GRAD(24), W(2), XY(24)
514. COMMON/VAR1/ EPS2, EPS3, EPS3JB, NFUNCT, NF
515. COMMON/VAR4/ XY
516. TOL=1.D-7
517. ICOUNT=0
518. IER=0
519. 9 CALL FUNCTB(NX, X, FSQ1, GRAD)
520. XA=0.DO
521. DO 50 K=1, NX
522. XA=XA+GRAD(K)**2
523. 50 CONTINUE
524. STEP=FSQ1/XA
525. 10 DO 1 K=1, NX
526. XY(K)=X(K)-STEP*GRAD(K)
527. 1 CONTINUE
528. AUX=XY(1)
529. NF=1
530. FSQ2=FUNCTN(AUX)
531. WRITE(6,*) ICOUNT, FSQ1, FSQ2
532. IF(FSQ2.LT.FSQ1) GO TO 11
533. IF(FSQ1.LT.TOL) GO TO 12
534. STEP=STEP/2.DO
535. ICOUNT=ICOUNT+1
536. IF(ICOUNT.LE.LIMIT) GO TO 10
537. IER=1
538. 12 FSQ=FSQ1
539. GO TO 13
540. 11 RATIO=FSQ1/FSQ2-1.DO
541. DO 2 K=1, NX
542. X(K)=XY(K)
543. 2 CONTINUE
544. IF(FSQ2.GT.TOL) GO TO 9
545. FSQ=FSQ2
546. 13 RETURN
547. END
548. SUBROUTINE FUNCTB(NX, X, FSQ, GRAD)
549. INTEGER EPS2, EPS3, EPS3JB
550. REAL*8 X, FSQ, GRAD, XY, FUNCTN, XA, XA2, REFS, DSQRT, F1, F2, GRAD1
551. DIMENSION X(24), GRAD(24), XY(24), GRAD1(24)
552. COMMON/VAR1/ EPS2, EPS3, EPS3JB, NFUNCT, NF
553. DATA REFS/ Z3410000000000000000/
554. XA=1.D-6
555. C XA=DSQRT(REFS)
556. DO 1 I=1, NX
557. XY(I)=X(I)
558. 1 CONTINUE
559. CALL FUNCTN(NX, X, FSQ, GRAD)

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560.      XA2=2.*XA
561.      DO 2 NF=1,NX
562.      XY(NF)=X(NF)+XA
563.      CALL FUNCTN(NX,XY,F2,GRAD1)
564.      XY(NF)=X(NF)-XA
565.      CALL FUNCTN(NX,XY,F1,GRAD1)
566.      XY(NF)=X(NF)
567.      GRAD(NF)=(F2-F1)/XA2
568. 2     CONTINUE
569.      RETURN
570.      END
571.      SUBROUTINE FUNCTL(NX,X,FSQ,GRAD)
572.      INTEGER EPS2,EP3,EP3JB
573.      REAL*8 X,FSQ,GRAD,XY,FUNCT,DER,XA,REPS,DSQRT
574.      DIMENSION X(24),GRAD(24),XY(24)
575.      COMMON/VAR1/EP3,EP3,EP3JB,NFUNCT,NF
576.      COMMON/VAR4/XY
577.      DATA REPS/Z3410000000000000/
578.      XA=1.D-6
579.  C     XA=DSQRT(REPS)
580.      DO 1 I=1,NX
581.      XY(I)=X(I)
582. 1     CONTINUE
583.      NF=1
584.      FSQ=FUNCT(X(NF))
585.      DO 2 NF=1,NX
586.  C     H=0.001
587.  C     IH=1
588.  C     CALL DDGAR(X(NF),H,IH,FUNCT,DER)
589.      GRAD(NF)=DER
590.      GRAD(NF)=(FUNCT(X(NF)+XA)-FUNCT(X(NF)-XA))/(XA+XA)
591.      XY(NF)=X(NF)
592. 2     CONTINUE
593.      RETURN
594.      END
595.  C *** SUBROUTINES TO EVALUATE THE COEFFICIENTS
596.  C *** X41(I,J),U1(I,J), AND U(I,J)
597.      SUBROUTINE FX41(X41,I,J)
598.      IMPLICIT REAL*8(A-H,O-Z)
599.      DIMENSION C1(100),C2(100),C3(100)
600.      CALL FIP(C2,I2,I)
601.      CALL FIP(C3,I3,J)
602.      CALL PMPY(C1,I1,C2,I2,C3,I3)
603.      CALL PINT(C2,I2,C1,I1)
604.      C2(1)=0.DO
605.      CALL PINT(C1,I1,C2,I2)
606.      X41=0.DO
607.      IF(I1.EQ.1) GO TO 2
608.      DO 1 I=2,I1
609.      X41=X41+C1(I)
610. 1     CONTINUE
611.      XX=(2*I-1)*(2*J-1)
612.      IF(DABS(X41).LT.1.D-7) X41=0.DO
613.      X41=X41*DSQRT(XX)
614. 2     RETURN
615.      END
616.      SUBROUTINE FUU1(U1,U,I,J)
617.      REAL*8 U1,U,XX,DSQRT,DABS,C1,C2,C3
618.      DIMENSION C1(100),C2(100),C3(100)
619.      CALL FIP(C1,I1,I)
620.      CALL FIP(C2,I2,J)
621.      CALL PMPY(C3,I3,C1,I1,C2,I2)
622.      CALL PINT(C1,I1,C3,I3)
623.      U1=0.DO
624.      U=0.DO
625.      DO 1 N=2,I1
626.      U1=U1+C1(N)
627.      U=U+C1(N)*0.75DO**(N-1)
628. 1     CONTINUE
629.      XX=(2*I-1)*(2*J-1)
630.      IF(DABS(U1).LT.1.D-7) U1=0.DO
631.      IF(DABS(U).LT.1.D-7) U=0.DO
632.      XX=DSQRT(XX)
633.      U1=U1*XX
634.      U=U*XX
635.      RETURN
636.      END
637.  C *** SUBROUTINES FI,FIP AND FIPP DEFINING THE SHIFTED
638.  C *** LEGENDRE POLYNOMIALS AND THEIR FIRST DERIVATIVES
639.      SUBROUTINE FI(COEF,I)

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640. REAL*8 COEFF
641. DIMENSION COEFF(8)
642. IF(1.EQ.1) GO TO 1
643. IF(1.EQ.2) GO TO 2
644. IF(1.EQ.3) GO TO 3
645. IF(1.EQ.4) GO TO 4
646. IF(1.EQ.5) GO TO 5
647. IF(1.EQ.6) GO TO 6
648. IF(1.EQ.7) GO TO 7
649. COEFF(1)=-1.DO
650. COEFF(2)=56.DO
651. COEFF(3)=-756.DO
652. COEFF(4)=4200.DO
653. COEFF(5)=-11500.DO
654. COEFF(6)=16632.DO
655. COEFF(7)=-12012.DO
656. COEFF(8)=3432.DO
657. GO TO 50
658. 7 COEFF(1)=1.DO
659. COEFF(2)=-42.DO
660. COEFF(3)=420.DO
661. COEFF(4)=-1680.DO
662. COEFF(5)=3150.DO
663. COEFF(6)=-2772.DO
664. COEFF(7)=924.DO
665. GO TO 50
666. 6 COEFF(1)=-1.DO
667. COEFF(2)=30.DO
668. COEFF(3)=-210.DO
669. COEFF(4)=560.DO
670. COEFF(5)=-630.DO
671. COEFF(6)=252.DO
672. GO TO 50
673. 5 COEFF(1)=1.DO
674. COEFF(2)=-20.DO
675. COEFF(3)=90.DO
676. COEFF(4)=-140.DO
677. COEFF(5)=70.DO
678. GO TO 50
679. 4 COEFF(1)=-1.DO
680. COEFF(2)=12.DO
681. COEFF(3)=-30.DO
682. COEFF(4)=20.DO
683. GO TO 50
684. 3 COEFF(1)=1.DO
685. COEFF(2)=-6.DO
686. COEFF(3)=6.DO
687. GO TO 50
688. 2 COEFF(1)=-1.DO
689. COEFF(2)=2.DO
690. GO TO 50
691. 1 COEFF(1)=1.DO
692. 50 RETURN
693. END
694. SUBROUTINE FIF(COEFF,IP,I)
695. REAL*8 COEFF,C1
696. DIMENSION COEFF(100),C1(100)
697. CALL FI(C1,I)
698. CALL PDER(COEFF,IP,C1,I)
699. RETURN
700. END
701. SUBROUTINE FIPP(COEFF,IPP,I)
702. REAL*8 COEFF,C1
703. DIMENSION COEFF(100),C1(100)
704. CALL FI(COEFF,I)
705. CALL PDER(C1,IP,COEFF,I)
706. CALL PDER(COEFF,IPP,C1,IP)
707. RETURN
708. END
709. C *** SSF SUBROUTINES PMFY,PDER AND PINT ***
710. SUBROUTINE PMFY(Z,IDIMZ,X,IDIMX,Y,IDIMY)
711. REAL*8 Z,X,Y
712. DIMENSION Z(1),X(1),Y(1)
713. IF(IDIMX*IDIMY) 10,10,20
714. 10 IDIMZ=0
715. GO TO 50
716. 20 IDIMZ=IDIMX+IDIMY-1
717. DO 30 I=1,IDIMZ
718. 30 Z(I)=0.DO
719. DO 40 I=1,IDIMX

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720. DO 40 J=1, IDIMY
721. K=I+J-1
722. Z(K)=X(I)*Y(J)+Z(K)
723. RETURN
724. END
725. SUBROUTINE PDER(Y, IDIMY, X, IDIMX)
726. REAL*8 Y, X, EXPT
727. DIMENSION X(1), Y(1)
728. IF (IDIMX-1) 3, 3, 1
729. 1 IDIMY=IDIMX-1
730. EXPT=0. DO
731. DO 2 I=1, IDIMY
732. EXPT=EXPT+1. DO
733. 2 Y(I)=X(I+1)*EXPT
734. GO TO 4
735. 3 IDIMY=1
736. Y(1)=0. DO
737. 4 RETURN
738. END
739. SUBROUTINE PINT(Y, IDIMY, X, IDIMX)
740. REAL*8 Y, X, EXPT
741. DIMENSION X(1), Y(1)
742. IDIMY=IDIMX+1
743. Y(1)=0. DO
744. IF (IDIMX) 1, 1, 2
745. 1 RETURN
746. 2 EXPT=1. DO
747. DO 3 I=2, IDIMY
748. Y(I)=X(I-1)/EXPT
749. 3 EXPT=EXPT+1. DO
750. GO TO 1
751. END
752. C **** END OF THE SUBROUTINES NEEDED TO EVALUATE X41(I,J) **
753. C *****
754. FUNCTION FUNCT(X)
755. IMPLICIT REAL*8(A-H, O-Z)
756. INTEGER EPS2, EPS3, EPS3JB
757. DIMENSION VE(8), WE(8), THETA(8), FV(8), FW(8), FTHETA(8), F11(8),
758. 1 XY(24)
759. DIMENSION DELTA(8,8), A(8), B(8), C(8), D(8,8), E(8,8), F(8,8,8), G(8,8,8),
760. 1 H(8,8,8), XI(8,8), XJ(8,8), XK(8,8,8), XM(8,8), XN(8,8), O(8,8), P(8,8),
761. 2 Q(8), R(8,8), S(8), A3(8,8,8), B3(8,8,8,8), C3(8,8,8,8), D3(8,8),
762. 3 E3(8,8,8,8), F3(8,8,8,8), G3(8,8), H3(8,8,8,8), XI3(8,8,8), XJ3(8,8),
763. 4 XK3(8,8), XL3(8,8), XM3(8,8), XN3(8,8,8), O3(8,8,8), P3(8,8,8), Q3(8,8,8),
764. 5 R3(8,8,8,8), S3(8,8,8,8), T3(8,8,8), DEL(8,8), DELF(8,8)
765. DIMENSION U3(8,8,8), V3(8,8,8), W3(8,8), X3(8,8,8), Y3(8,8,8), Z3(8,8,8),
766. 1 A4(8,8,8,8), B4(8,8,8,8), C4(8,8,8,8), D4(8,8,8,8), E4(8,8,8,8),
767. 2 F4(8,8,8,8), G4(8,8,8,8), H4(8,8), XI4(8,8,8,8), XJ4(8,8,8), XK4(8,8),
768. 3 XL4(8,8,8,8), XM4(8,8,8), XN4(8,8), O4(8,8), P4(8,8,8), Q4(8,8,8,8),
769. 4 R4(8,8,8,8), S4(8,8,8), T4(8,8), U4(8), V4(8,8,8,8), W4(8,8,8), X41(8,8),
770. COMMON/VAR1/EPS2, EPS3, EPS3JB, NFUNCT, NF
771. COMMON/VAR4/XY
772. COMMON/VAR2/X1, X2, XX3, X4, X5, X6, X7, X8, X9, X10, X11, X12, X13, X14, X15,
773. 1 X16, X17, X18, X19, X20, X21, X22, X23, X24, X25, X26, X27, X28, X29, X30, X31,
774. 2 X32, X33, X34, X35, X36, X37, X38, X39, X40, X41, Y1, Y2, YY3, Y4, Y5, Y6, Y7, Y8,
775. 3 Y9, Y10, Y11, Y12, Y13, Y14, Y15, Y16, Y17, Y18, Y19, Y20, Y21, Y22, Y23, Y24, Z1,
776. 4 Z2, Z23, Z4, Z5, Z7, A11, A12, A21, A22, DCS1, CHORD, SINB, COSB, S2B, C2B, SBCB
777. 5 COSFC, C2BOEA, SQRT2, S3C, SCCC, COS2C, SIN2C, VEN1, VEN, WEN1, WEN, THETA
778. COMMON/VAR3/CDOOP1, SINPC, C2C, S2C, DEL, DELF, DELTA, A, B, C, D, E, F, G, H, X,
779. 1, XJ, XK, XM, XN, O, P, Q, R, S, A3, B3, C3, D3, E3, F3, G3, H3, XI3, XJ3, XK3, XL3, XM3,
780. 2, XN3, O3, P3, Q3, R3, S3, T3, U3, V3, W3, X3, Y3, Z3, A4, B4, C4, D4, E4, F4, G4, H4,
781. 3 XI4, XJ4, XK4, XL4, XM4, XN4, O4, P4, Q4, R4, S4, T4, U4, V4, W4, F11
782. C *****
783. C DEFINITION OF THE VECTOR [X(1), X(2), ..., X(3*N-4)] =
784. C [VE(1), VE(2), ..., VE(N-2); WE(1), WE(2), ..., WE(N-2); THETA(1),
785. C THETA(2), ..., THETA(N)] USED IN THE OPTIMIZATION ROUTINE.
786. XY(NF)=X
787. NN=NFUNCT-2
788. DO 3 I=1, NN
789. VE(I)=XY(I)
790. I1=NN+I
791. WE(I)=XY(I1)
792. I2=2*NN+I
793. THETA(I)=XY(I2)
794. 3 CONTINUE
795. I1=3*NFUNCT-5
796. I2=NFUNCT-1
797. THETA(I2)=XY(I1)
798. I1=I1+1
799. THETA(NFUNCT)=XY(I1)

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800. C *****
801. C
802. C CALCULATION OF VE(NFUNCT-1),VE(NFUNCT),WE(NFUNCT-1) AND WE(NFUNCT)
803. C ACCORDING TO THE EQUATIONS ON PAGE 39 OF THE NOTES.
804. C   AUX1=VE(1)
805. C   N1=1
806. C   AUX2=0
807. C   AUX3=WE(1)
808. C   AUX4=0
809. C   N2=NFUNCT-2
810. C   IF(N2.EQ.1) GO TO 55
811. C   DO 5 I=2,N2
812. C   SS=DSQRT(2.DO*I-1.DO)
813. C   AUX1=AUX1-N1*SS*VE(I)
814. C   AUX2=AUX2+N1*I*(I-1)*SS*VE(I)
815. C   AUX3=AUX3-N1*SS*WE(I)
816. C   AUX4=AUX4+N1*I*(I-1)*SS*WE(I)
817. C   N1=-N1
818. C   CONTINUE
819. C   N1=NFUNCT-1
820. C   VE(N1)=A11*AUX1+A12*AUX2
821. C   VE(NFUNCT)=A21*AUX1+A22*AUX2
822. C   WE(N1)=A11*AUX3+A12*AUX4
823. C   WE(NFUNCT)=A21*AUX3+A22*AUX4
824. C   VEN1=VE(N1)
825. C   VEN=VE(NFUNCT)
826. C   WEN1=WE(N1)
827. C   WEN=WE(NFUNCT)
828. C *****
829. C *
830. C *   CALCULATION OF THE INFLOW RATIO LAMBDA *
831. C *   (XLMBDA IN THE PROGRAM) *
832. C *
833. C *   CALL XLBDA(XLMBDA) *
834. C *
835. C *   XLMBDA=0.03927DO*(DSQRT(1.DO+38.1972DO*THETAC)-1.DO) *
836. C *
837. C *****
838. C   X2=XLMBDA*(EPS2*XLMBDA*COSB*COSPC-EPS3*CHORD*SINB/2)
839. C   XX3=XLMBDA*C2B*SINPC*(1+EPS3*CDOOPI*C2C)
840. C   X8=EPS3*X1*XLMBDA
841. C   X6=X8*C2BOEA*COSB*SINPC/2
842. C   X13=1+2*X8*SINB*COSPC
843. C   X17=EPS3*XLMBDA*S2C*COSPC
844. C   X18=EPS3*XLMBDA*SINPC
845. C   X19=EPS2*XLMBDA*COSB
846. C   X29=EPS3*XLMBDA*COSPC
847. C   X30=X29*(1+S2C)
848. C   X32=EPS3*XLMBDA/2
849. C   X34=EPS3*XLMBDA*(C2C-3*S2C)
850. C   X35=EPS3*X31*XLMBDA/2
851. C   Y2=SBCB+X37*XLMBDA+X1*CDOOPI*X3Q*COSB-X16*CHORD/2
852. C   Y4=C2BOEA*(SBCB+X37*XLMBDA)/2
853. C   Y8=X29*SINB
854. C   Y9=EPS2*X9+X29*SINB*C2C
855. C   Y12=EPS3*XLMBDA*SCCC
856. C   Y14=SINPC*(X19-EPS3*CHORD*SINB*COSPC/2)
857. C   Y20=X29*C2C
858. C   Y21=EPS3*XLMBDA*X31*SCCC/2
859. C   II=1
860. C   DO 6 I=1,NFUNCT
861. C   FI10=(1-II)*FI1(I)
862. C   FV(I)=-X1*(X2*A(I))-XX3*B(I)-X4*C(I)+X5*FI10+X6*H4(I)
863. C   FW(I)=-X31*C(I)+Y2*B(I)+Y3*FI10+Y4*H4(I)-Y5*U4(I)
864. C   FTHETA(I)=Z1*Q(I)+Z2*S(I)
865. C   Z4A=(1-2*I)/SQRT2
866. C   IJ=1
867. C   DO 7 J=1,NFUNCT
868. C   Z4B=J*(J-1)*FI1(J)
869. C   FV(I)=FV(I)+(X7*(DELTA(I,J)+C2BOEA*D3(I,J))+X8*(X9*WB(I,J)-X10*DEL
870. C   1F(I,J)+X11*O(I,J))*WE(J)+(X12*DELTA(I,J)-X13*DELF(I,J)+C2B*D(I,J)
871. C   2)+X14*D3(I,J)+X15*(XJ3(I,J)-G3(I,J)/6)+X16*(E(I,J)-X17*O(I,J))*V
872. C   3(J)+X1*(COSPC*XI(I,J)+X18*O4(I,J))*X19-X20*XJ(I,J)-X21*XI(I,J)
873. C   4+X22*XK4(I,J))*THETA(J)
874. C   FW(I)=FW(I)+(Y6*(DELTA(I,J)+C2BOEA*D3(I,J))+C2B*D(I,J)+X15*(XJ3(I
875. C   1J)-G3(I,J)/6)+Y7*XK3(I,J)-EPS3*S2B*DELF(I,J)-X1*(Y8*DELF(I,J)+Y9*
876. C   2(I,J)-Y10*E(I,J))*WE(J)-(X7*(DELTA(I,J)+C2BOEA*D3(I,J))-Y11*(Y12
877. C   3(I,J)+E(I,J))*VE(J)-X1*(Y13*XJ(I,J)+Y14*XI(I,J)+Y15*XK4(I,J))*
878. C   4THETA(J)
879. C   FTHETA(I)=FTHETA(I)+(Z23*DEL(I,J)-DCSI*(F(I,J)+2*C2BOEA*XN(I,J))+

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1Z4*XXN(I,J))*THETA(J)+Z5*R(I,J)*WE(J)
IF(EPS2.EQ.0) GO TO 77
IK=1
DO 8 K=1,NFUNCT
Z6C=K*(K-1)*F11(K)
Z8A=Z6B*Z6C
Z6=IJ*IK*Z6A*Z8A
Z8=-NAI*Z8A*(J-2)*(J+1)/SQRT2
Z8A=NAI*Z8A*(K-2)*(K+1)
FV(I)=FV(I)+(X23*G(I,K,J)-2*X7*XXK(J,K,I))*THETA(J)*VE(K)+
1(DCSI*A3(I,J,K)+X24*XXK(J,K,I)-X25*(X26*G(I,K,J)+X27*Y3(I,K,J)
2))*THETA(J)*WE(K)-(EPS3*SBCB*(F(I,J,K)+X41(I,J)*IK*F11(K))-X28*
3(C2C*(X29*P3(I,J,K)-SINPC*Q3(I,J,K))+T3(I,J,K)-S3C*Q3(I,J,K)+X30*
4XN3(I,J,K)+2*X29*Z3(I,J,K))*VE(J)*WE(K)
FV(I)=FV(I)-X31*(X32*(X33*P3(I,J,K)+S2C*XXN3(I,J,K)
1+F(J,K,I)-2*Z3(I,J,K))-SCCC*(Q3(I,J,K)-Q3(I,J,K)/2))*VE(J)*VE(K)
2-X31*(SCCC*U3(I,J,K)-X34*X3(I,J,K))*THETA(J)*THETA(K)/2
3+X35*(C2C*XXN3(I,J,K)-F(J,K,I))*WE(J)*WE(K)
FW(I)=FW(I)+(X24*XXK(J,K,I)-DCSI*P4(I,J,K)-Y16*G(I,K,J))*THETA
1E(J)*VE(K)-X37*(SINPC*(X29*P3(I,K,J)-SINPC*Q3(I,K,J))-T3(I,J,K)+
2Q3(I,J,K))*VE(J)*WE(K)+(2*X7*XXK(J,K,I)+Y17*(Y18*G(I,J,K)+X27*Y3(I
3,J,K))*WE(J)*THETA(K)-(EPS3*SBCB*(F(I,J,K)+F(J,K,I)/2+X41(I,J)*
4IK*F11(K))+X28*(C2C*(X29*P3(I,J,K)-SINPC*Q3(I,J,K))+Y19*Q3(I,J,K)-
5Y20*XXN3(I,J,K)+SINPC*S4(I,J,K)-X29*F(J,K,I)/2))*WE(J)*WE(K)
FW(I)=FW(I)-(EPS3*SBCB*(F(J,K,I)/2-X28*(SINPC*(Q3(I,J,K)-
12*T3(I,J,K))+X29*(Z3(I,J,K)-XN3(I,J,K)/2-F(J,K,I)/2))+SINPC*S4(I,
2J,K))*VE(J)*VE(K)+Y21*X3(I,J,K)*THETA(J)*THETA(K)
FTHETA(I)=FTHETA(I)+DCSI*(A3(I,J,K)+Z6)*VE(J)*WE(K)+Z7*(XK(I
1,J,K)+Z8)*(VE(J)*VE(K)-WE(J)*WE(K))*SCCC-VE(J)*WE(K)*COS2C)
IF(EPS3.EQ.0) GO TO 88
DO 9 L=1,NFUNCT
NAL=1
IF(L.EQ.3.OR.L.EQ.5.OR.L.EQ.7) NAL=-1
Z9=NAL*Z8A
FV(I)=FV(I)+Z7*(THETA(J)*THETA(K)*(WE(L)*SIN2C+VE(L)*COS2C)*B3(I
1,J,K,L)-SCCC*WE(J)*(VE(K)*VE(L)+WE(K)*WE(L))*C3(I,J,K,L))+X12*
2E3(I,J,K,L)-C2B*(H3(I,J,K,L)+X13(I,J,K,L)/2))*VE(J)*VE(K)*VE(L)/2+
3(X12*E3(I,J,K,L)/2+DCSI*F3(I,J,K,L)-C2B*(H3(I,J,K,L)+X13(I,J,K,L)/
42)/2)*VE(J)*WE(K)*WE(L)+X31*(C2C*R3(I,J,K,L)+COS2C*A4(I,J,K,L)-
5X36*C4(I,J,K,L)-COS2C*X14(I,J,K,L)/2)*VE(J)*VE(K)*THETA(L)
FV(I)=FV(I)-X37*(C2C*R3(I,J,K,L)-X38*A4(I,J,K,L)+3*S2C*C4(I,J,K,L)
1)*VE(J)*WE(K)*THETA(L)-X39*B4(I,J,K,L)*THETA(J)*THETA(K)*
2THETA(L)-X40*WE(J)*WE(K)*THETA(L)*X14(I,J,K,L)
FW(I)=FW(I)+Z7*THETA(J)*THETA(K)*(VE(L)*SIN2C-WE(L)*COS2C)*B3(I
1,J,K,L)-2*X7*(C3(I,J,K,L)+F3(I,J,K,L)/4+F3(I,J,K,L)/2)*WE(J)*WE(K)*
2WE(L)-X7*F3(I,J,K,L)*VE(J)*VE(K)*VE(L)/2+(X12*Q4(I,J,K,L)-DCSI*
3R4(I,J,K,L)-C2B*(H3(I,J,K,L)+X13(I,J,K,L)/2)/2)*WE(J)*VE(K)*VE(L)+
4(Y6*Q4(I,J,K,L)-C2B*(H3(I,J,K,L)+X13(I,J,K,L)/2)/2)*WE(J)*WE(K)*
5WE(L)
FW(I)=FW(I)+X37*(SCCC*(R3(I,J,K,L)+2*(C4(I,J,K,L)-A4(I,J,K,L)))*
1WE(J)*VE(K)*THETA(L)-C2C*(R3(I,J,K,L)-C4(I,J,K,L)/2)*WE(J)*WE(K)
2*THETA(L)-Y22*B4(I,J,K,L)*THETA(J)*THETA(K)*THETA(L))
3-Y23*(2*A4(I,J,K,L)-C4(I,J,K,L))*VE(J)*VE(K)*THETA(L)
4+Y24*X14(I,J,K,L)*(VE(J)*VE(K)+WE(J)*WE(K))*THETA(L)
FTHETA(I)=FTHETA(I)+Z7*(B3(I,J,K,L)+Z9)*(VE(J)*VE(K)-WE(J)*WE(K))
1+COS2C+2*VE(J)*WE(K)*SIN2C)*THETA(L)
9 CONTINUE
88 IK=-IK
8 CONTINUE
77 IJ=-IJ
7 CONTINUE
41 II=-II
6 CONTINUE
FUNCT=0
DO 10 I=1,NFUNCT
FUNCT=FUNCT+FV(I)**2+FW(I)**2+FTHETA(I)**2
C FUNCT=FUNCT+DABS(FV(I))+DABS(FW(I))+DABS(FTHETA(I))
C FUNCT=FUNCT+DEXP(FV(I))+DEXP(FW(I))+DEXP(FTHETA(I))-3.DO
C FUNCT=FUNCT+DSQRT(FV(I)**2)+DSQRT(FW(I)**2)+DSQRT(FTHETA(I)**2)
10 CONTINUE
RETURN
END
SUBROUTINE FUNCTN(NX,X,FSQ,GRAD)
IMPLICIT REAL*8(A-H,O-Z)
INTEGER EPS2,EPS3,EPS3JB
DIMENSION VE(8),WE(8),THETA(8),FV(8),FW(8),FTHETA(8),F11(8)
1,X(24),XG(8),U(8,8),GRAD(24),GV(8,24),GW(8,24),GT(8,24)
DIMENSION DELTA(8,8),A(8),B(8),C(8),D(8,8),E(8,8),F(8,8,8),G(8,8,8
1),H(8,8,8),XI(8,8),XJ(8,8),XK(8,8,8),XM(8,8),XN(8,8),O(8,8),P(8,8)
2,Q(8),R(8,8),S(8),A3(8,8,8),B3(8,8,8,8),C3(8,8,8,8),D3(8,8)
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960. 3E3(8,8,8,8),F3(8,8,8,8),G3(8,8),H3(8,8,8,8),X13(8,8,8,8),X13(8,8),
961. 4XK3(8,8),XL3(8,8),XMG(8,8),XN3(8,8,8),O3(8,8,8),P3(8,8,8),Q3(8,8,8),
962. 5),R3(8,8,8,8),S3(8,8,8,8),T3(8,8,8),DEL(8,8),DELT(8,8)
963. DIMENSION U3(8,8,8),V3(8,8,8),W3(8,8),X3(8,8,8),Y3(8,8,8),Z3(8,8,8),
964. 1),A4(8,8,8,8),B4(8,8,8,8),C4(8,8,8,8),D4(8,8,8,8),E4(8,8,8,8),
965. 2F4(8,8,8,8),G4(8,8,8,8),H4(8),XI4(8,8,8,8),XJ4(8,8,8),XK4(8,8),
966. 3XL4(8,8,8,8),XM4(8,8,8),XN4(8,8),O4(8,8),P4(8,8,8),Q4(8,8,8,8),
967. 4R4(8,8,8,8),S4(8,8,8),T4(8,8),U4(8),V4(8,8,8,8),W4(8,8,8),X41(8,8)
968. COMMON/VAR1/EP32,EP33,EP33JB,NFUNCT,NF
969. COMMON/VAR2/X1,X2,XX3,X4,X5,X6,X7,X8,X9,X10,X11,X12,X13,X14,X15,
970. 1X16,X17,X18,X19,X20,X21,X22,X23,X24,X25,X26,X27,X28,X29,X30,X31,
971. 2X32,X33,X34,X35,X36,X37,X38,X39,X40,X41,Y1,Y2,Y3,Y4,Y5,Y6,Y7,Y8,
972. 3Y9,Y10,Y11,Y12,Y13,Y14,Y15,Y16,Y17,Y18,Y19,Y20,Y21,Y22,Y23,Y24,Z1,
973. 4Z2,Z3,Z4,Z5,Z7,A11,A12,A21,A22,DCS1,CHORD,SINB,COSB,S2B,C2B,SBCB,
974. 5COSPC,C2BOEA,SQRT2,S3C,SCCC,COS2C,SIN2C,VEN1,VEN,WEN1,WEN,THETAC,
975. COMMON/VAR3/CDOCFI,SINPC,C2C,S2C,DEL,DELF,DELTA,A,B,C,D,E,F,G,H,XI
976. 1,XJ,XK,XM,XN,O,P,Q,R,S,A3,B3,C3,D3,E3,F3,G3,H3,XI3,XJ3,XK3,XL3,XM3
977. 2,XN3,O3,F3,Q3,R3,S3,T3,U3,V3,W3,X3,Y3,Z3,A4,B4,C4,D4,E4,F4,G4,H4,
978. 3XI4,XJ4,XK4,XL4,XM4,XN4,O4,P4,Q4,R4,S4,T4,U4,V4,W4,FI1
979. COMMON/VAR5/SIGMA,XG,U
980. N2=2*NFUNCT
981. DO 3 I=1,NFUNCT
982. J1=NFUNCT+I
983. J2=N2+I
984. VE(I)=X(I)
985. WE(I)=X(J1)
986. THETA(I)=X(J2)
987. 3 CONTINUE
988. C *****
989. C **
990. C ** CALCULATION OF THE INFLOW RATIO LAMBDA **
991. C ** (XLMBDA IN THE PROGRAM) **
992. C **
993. PHIE=0.DO
994. DO 1 I=1,NFUNCT
995. PHIE=PHIE+XG(I)*THETA(I)
996. AUX=0.DO
997. DO 2 J=1,NFUNCT
998. AUX=AUX+U(I,J)*WE(J)
999. 2 CONTINUE
1000. PHIE=PHIE+AUX*VE(I)
1001. 1 CONTINUE
1002. PHIE=PHIE+THETAC
1003. IF(PHIE.NE.0.DO) GO TO 100
1004. XLMBDA=0.DO
1005. GO TO 101
1006. 100 AUX=SIGMA*0.3927DO
1007. ABSPHI=DABS(PHIE)
1008. II=1
1009. IF(PHIE.LT.0.DO) II=-1
1010. XLMBDA=AUX*II*(DSQRT(1.DO+3.81972DO*ABSPHI/SIGMA)-1.DO)
1011. 1-1.DO)
1012. C *
1013. C *****
1014. C 101 X2=XLMBDA*(EP32*XLMBDA*COSB*COSPC-EP33*CHORD*SINB/2)
1015. XX3=XLMBDA*C2B*SINPC*(1+EP33*CDOCFI*C2C)
1016. X8=EP33*X1*XLMBDA
1017. X6=X8*C2BOEA*COSB*SINPC/2
1018. X13=1+2*X8*SINB*COSPC
1019. X17=EP33*XLMBDA*S2C*COSPC
1020. X18=EP33*XLMBDA*SINPC
1021. X19=EP32*XLMBDA*COSB
1022. X29=EP33*XLMBDA*COSPC
1023. X30=X29*(1+S2C)
1024. X32=EP33*XLMBDA/2
1025. X34=EP33*XLMBDA*(C2C-3*S2C)
1026. X35=EP33*X31*XLMBDA/2
1027. Y2=SBCB+X37*XLMBDA+X1*CDOCFI*X30*COSB-X16*CHORD/2
1028. Y4=C2BOEA*(SBCB+X37*XLMBDA)/2
1029. Y8=X29*SINB
1030. Y9=EP32*X9+X29*SINB*C2C
1031. Y12=EP33*XLMBDA*SCCC
1032. Y14=SINPC*(X19-EP33*CHORD*SINB*COSPC/2)
1033. Y20=X29*C2C
1034. Y21=EP33*XLMBDA*X31*SCCC/2
1035. DO 66 I=1,NFUNCT
1036. DO 67 J=1,NX
1037. GV(I,J)=0.DO
1038. GW(I,J)=0.DO
1039. GT(I,J)=0.DO

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1040. C 67 CONTINUE
1041. 66 CONTINUE
1042. II=1
1043. DO 6 I=1,NFUNCT
1044. FI10=2*I
1045. FV(I)=-X1*(X2*A(I)-X3*B(I)-X4*C(I))+X5*FI10+X6*H4(I)
1046. FW(I)=-X31*C(I)+Y2*B(I)+Y3*FI10+Y4*H4(I)-Y5*U4(I)
1047. FTHETA(I)=Z1*Q(I)+Z2*S(I)
1048. DO 7 J=1,NFUNCT
1049. J1=NFUNCT+J
1050. J2=N2+J
1051. GVIJ=X12*DELTA(I,J)-X13*DELF(I,J)+C2B*D(I,J)+X14*D3(I,J)
1052. 1+X15*(XJ3(I,J)-G3(I,J)/6)+X16*(E(I,J)-X17*Q(I,J))
1053. GVIJ1=X7*(DELTA(I,J)+C2BOEA*D3(I,J))+X8*(X9*W3(I,J)-X10*DELF(I,J)
1054. 1+X11*Q(I,J))
1055. GVIJ2=X1*((COSPC*X1(I,J)+X18*Q4(I,J))*X19-X20*XJ(I,J)
1056. 1-X21*X1(I,J)+X22*XK4(I,J))
1057. GWIJ=Y11*(Y12*Q(I,J)+E(I,J))-X7*(DELTA(I,J)+C2BOEA*D3(I,J))
1058. GVIJ1=Y6*(DELTA(I,J)+C2BOEA*D3(I,J))+C2B*D(I,J)+X15*(XJ3(I,J)
1059. 1-G3(I,J)/6)+Y7*XK3(I,J)-EPS3*S2B*DELF(I,J)-X1*(Y8*DELF(I,J)
1060. 2+Y9*Q(I,J)-Y10*E(I,J))
1061. GWIJ2=-X1*(Y13*XJ(I,J)+Y14*X1(I,J)+Y15*XK4(I,J))
1062. GT(I,J)=0.D0
1063. GTIJ1=Z5*R(I,J)
1064. GTIJ2=Z23*DEL(I,J)-DCSI*(P(I,J)+2*C2BOEA*XN(I,J))+Z4*XN(I,J)
1065. FV(I)=FV(I)+GVIJ*VE(J)+GVIJ1*WE(J)+GVIJ2*THETA(I,J)
1066. FW(I)=FW(I)+GWIJ*VE(J)+GWIJ1*WE(J)+GWIJ2*THETA(I,J)
1067. FTHETA(I)=FTHETA(I)+GTIJ1*WE(J)+GTIJ2*THETA(I,J)
1068. GV(I,J)=GV(I,J)+GVIJ
1069. GV(I,J1)=GV(I,J1)+GVIJ1
1070. GV(I,J2)=GV(I,J2)+GVIJ2
1071. GW(I,J)=GW(I,J)+GWIJ
1072. GW(I,J1)=GW(I,J1)+GWIJ1
1073. GW(I,J2)=GW(I,J2)+GWIJ2
1074. GT(I,J1)=GT(I,J1)+GTIJ1
1075. GT(I,J2)=GT(I,J2)+GTIJ2
1076. IF(EPS2.EQ.0) GO TO 7
1077. DO 8 K=1,NFUNCT
1078. K1=NFUNCT+K
1079. K2=N2+K
1080. VVFW=X31*(SCCC*(Q3(I,J,K)-Q3(I,J,K)/2)-X32*(X33*P3(I,J,K)+S2C*XN3(
1081. 1I,J,K)+F(J,K,I)-2*Z3(I,J,K)))
1082. VVFW=-EPS3*SBCB*F(I,J,K)+X28*(C2C*(X29*P3(I,J,K)-SINPC*Q3(I,J,K)
1083. 1)+T3(I,J,K)-S3C*Q3(I,J,K)+X30*XN3(I,J,K)+2*X29*Z3(I,J,K))
1084. VTFV=X23*G(I,J,K)-2*X7*XK(K,J,I)
1085. WWFW=X35*(C2C*XN3(I,J,K)-F(J,K,I))
1086. WTFV=DCSI*A3(I,K,J)+X24*XK(K,J,I)-X25*(X26*G(I,J,K)+X27*Y3(I,J,K))
1087. TTFV=X31*(X34*X3(I,J,K)-SCCC*U3(I,J,K))/2
1088. VVFW=X28*(SINPC*(Q3(I,J,K)-2*T3(I,J,K))+X29*(Z3(I,J,K)
1089. 1-XN3(I,J,K)/2-F(J,K,I)/2)+SINPC*S4(I,J,K))-EPS3*SBCB*F(J,K,I)/2
1090. VVFW=X37*(T3(I,J,K)-Q3(I,J,K)-SINPC*(X29*P3(I,J,K)-SINPC*Q3(I,J,K)
1091. 1))
1092. VTFW=X24*XK(K,J,I)-DCSI*P4(I,K,J)-Y16*G(I,J,K)
1093. WWFW=X28*(C2C*(X29*P3(I,J,K)-SINPC*Q3(I,J,K))+Y19*Q3(I,J,K)-
1094. 1Y20*XN3(I,J,K)+SINPC*S4(I,J,K)-X29*F(J,K,I)/2)
1095. 2-EPS3*SBCB*(F(I,J,K)+F(J,K,I)/2)
1096. WTFW=2*X7*XK(J,K,I)+Y17*(Y18*G(I,J,K)+X27*Y3(I,J,K))
1097. TTFW=Y21*X3(I,J,K)
1098. VVFT=Z7*XK(I,J,K)
1099. VVFT=DCSI*A3(J,I,K)-VVFT*DCS2C
1100. VVFT=VVFT*SCCC
1101. WWFT=-VVFT
1102. AUX1=VVFW*VE(K)+VVFW*WE(K)+VTFV*THETA(K)
1103. AUX2=WWFW*WE(K)+WTFV*THETA(K)
1104. AUX3=TTFV*THETA(K)
1105. FV(I)=FV(I)+VE(J)*AUX1+WE(J)*AUX2+THETA(J)*AUX3
1106. GV(I,J)=GV(I,J)+AUX1
1107. GV(I,K)=GV(I,K)+VVFW*VE(J)
1108. GV(I,J1)=GV(I,J1)+AUX2
1109. GV(I,K1)=GV(I,K1)+VVFW*VE(J)+WWFW*WE(J)
1110. GV(I,J2)=GV(I,J2)+AUX3
1111. GV(I,K2)=GV(I,K2)+VTFV*VE(J)+WTFV*WE(J)+TTFV*THETA(J)
1112. AUX1=VVFW*VE(K)+VVFW*WE(K)+VTFW*THETA(K)
1113. AUX2=WWFW*WE(K)+WTFW*THETA(K)
1114. AUX3=TTFW*THETA(K)
1115. FW(I)=FW(I)+VE(J)*AUX1+WE(J)*AUX2+THETA(J)*AUX3
1116. GW(I,J)=GW(I,J)+AUX1
1117. GW(I,K)=GW(I,K)+VVFW*VE(J)
1118. GW(I,J1)=GW(I,J1)+AUX2
1119. GW(I,K1)=GW(I,K1)+VVFW*VE(J)+WWFW*WE(J)

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1120.      C      GW(I,J2)=GW(I,J2)+AUX3
1121.      C      GW(I,K2)=GW(I,K2)+VTFW*VE(J)+WTFW*WE(J)+TTFW*THETA(J)
1122.      AUX1=VVFT*VE(K)+VWFT*WE(K)
1123.      AUX2=WWFT*WE(K)
1124.      C      GT(I,J)=GT(I,J)+AUX1
1125.      C      GT(I,K)=GT(I,K)+VVFT*VE(J)
1126.      C      GT(I,J1)=GT(I,J1)+AUX2
1127.      C      GT(I,K1)=GT(I,K1)+VWFT*VE(J)+WWFT*WE(J)
1128.      FTHETA(I)=FTHETA(I)+VE(J)*AUX1+WE(J)*AUX2
1129.      IF(EPS3.EQ.0) GO TO 8
1130.      DO 9 L=1,NFUNCT
1131.      L1=NFUNCT+L
1132.      L2=N2+L
1133.      VVVFW=(X12*E3(I,J,K,L)-C2B*(H3(I,J,K,L)+X13(I,J,K,L)/2))/2
1134.      VVWFV=-Z7*SCCC*C3(I,L,K,J)
1135.      VVTFV=X31*(C2C*R3(I,J,K,L)+COS2C*(A4(I,J,K,L)-X14(I,J,K,L)/2)
1136.      1-X36*C4(I,J,K,L))
1137.      VVWFV=VVVFW+DCSI*F3(I,J,K,L)
1138.      VVTFV=X37*(X38*A4(I,J,K,L)-C2C*R3(I,J,K,L)-3*S2C*C4(I,J,K,L))
1139.      VTTFW=Z7*COS2C*B3(I,L,K,J)
1140.      WWWFW=-Z7*SCCC*C3(I,J,K,L)
1141.      WWTFW=-X40*X14(I,J,K,L)
1142.      WTTFW=Z7*SIN2C*B3(I,L,K,J)
1143.      TTTFW=-X39*B4(I,J,K,L)
1144.      VVVFW=-X7*F3(I,J,K,L)/2
1145.      VVWFV=X12*Q4(I,L,K,J)-DCSI*R4(I,L,K,J)-C2B*(H3(I,L,K,J)
1146.      J+X13(I,L,K,J)/2)/2
1147.      VVTFW=Y23*(C4(I,J,K,L)-2*A4(I,J,K,L))+Y24*X14(I,J,K,L)
1148.      VVTFW=X37*SCCC*(R3(I,K,J,L)-2*A4(I,J,K,L)+2*C4(I,K,J,L))
1149.      VTTFW=WTTFW
1150.      WWWFW=Y6*Q4(I,J,K,L)-C2B*(H3(I,J,K,L)+X13(I,J,K,L)/2)/2
1151.      1-2*X7*(C3(I,J,K,L)+F3(I,K,J,L)/4+F3(I,J,K,L)/2)
1152.      WWTFW=X37*C2C*(C4(I,J,K,L)/2-R3(I,J,K,L))+Y24*X14(I,J,K,L)
1153.      WTTFW=-VTTFW
1154.      TTTFW=-X37*Y22*B4(I,J,K,L)
1155.      AUX1=Z7*B3(J,I,L,K)
1156.      VVTFV=AUX1*COS2C
1157.      WWTFT=-VVTFV
1158.      VVTFV=2*SIN2C*AUX1
1159.      AUX=THETA(K)*THETA(L)
1160.      AUX4=VVVFW*VE(L)+VVWFV*WE(L)+VVTFV*THETA(L)
1161.      AUX5=WWWFW*WE(L)+WWTFW*THETA(L)
1162.      AUX6=WWWFW*WE(L)+WWTFW*THETA(L)
1163.      AUX1=AUX4*VE(K)+AUX5*WE(K)+VTTFW*AUX
1164.      AUX2=AUX6*WE(K)+WTTFW*AUX
1165.      AUX3=TTTFV*AUX
1166.      C      GV(I,J)=GV(I,J)+AUX1
1167.      C      GV(I,K)=GV(I,K)+AUX4*VE(J)
1168.      C      GV(I,L)=GV(I,L)+VVVFW*VE(J)*VE(K)
1169.      C      GV(I,J1)=GV(I,J1)+AUX2
1170.      C      GV(I,K1)=GV(I,K1)+AUX5*VE(J)+AUX6*WE(J)
1171.      C      GV(I,L1)=GV(I,L1)+VE(J)*(VVWFV*VE(K)+VWFW*WE(K))+WWWFW*WE(J)*
1172.      1WE(K)
1173.      C      GV(I,J2)=GV(I,J2)+AUX3
1174.      C      GV(I,K2)=GV(I,K2)+(VTTFW*VE(J)+WTTFW*WE(J)+TTTFW*THETA(J))*
1175.      1THETA(L)
1176.      C      GV(I,L2)=GV(I,L2)+(VVTFV*VE(K)+VWTFV*WE(K)+VTTFW*THETA(K))*VE(J)
1177.      1+(WWTFW*WE(K)+WTTFW*THETA(K))*WE(J)+TTTFW*THETA(J)*THETA(K)
1178.      C      FV(I)=FV(I)+VE(J)*AUX1+WE(J)*AUX2+THETA(J)*AUX3
1179.      C      AUX4=VVVFW*VE(L)+VVWFV*WE(L)+VVTFW*THETA(L)
1180.      C      AUX5=WWWFW*WE(L)+WWTFW*THETA(L)
1181.      C      AUX6=WWWFW*WE(L)+WWTFW*THETA(L)
1182.      C      AUX1=AUX4*VE(K)+AUX5*WE(K)+VTTFW*AUX
1183.      C      AUX2=AUX6*WE(K)+WTTFW*AUX
1184.      C      AUX3=TTTFW*AUX
1185.      C      GW(I,J)=GW(I,J)+AUX1
1186.      C      GW(I,K)=GW(I,K)+AUX4*VE(J)
1187.      C      GW(I,L)=GW(I,L)+VVVFW*VE(J)*VE(K)
1188.      C      GW(I,J1)=GW(I,J1)+AUX2
1189.      C      GW(I,K1)=GW(I,K1)+AUX5*VE(J)+AUX6*WE(J)
1190.      C      GW(I,L1)=GW(I,L1)+VE(J)*(VVWFV*VE(K)+VWFW*WE(K))+WWWFW*WE(J)*
1191.      1WE(K)
1192.      C      GW(I,J2)=GW(I,J2)+AUX3
1193.      C      GW(I,K2)=GW(I,K2)+(VTTFW*VE(J)+WTTFW*WE(J)+TTTFW*THETA(J))*
1194.      1THETA(L)
1195.      C      GW(I,L2)=GW(I,L2)+(VVTFW*VE(K)+VWTFW*WE(K)+VTTFW*THETA(K))*VE(J)
1196.      1+(WWTFW*WE(K)+WTTFW*THETA(K))*WE(J)+TTTFW*THETA(J)*THETA(K)
1197.      C      FW(I)=FW(I)+VE(J)*AUX1+WE(J)*AUX2+THETA(J)*AUX3
1198.      C      AUX1=VVTFV*VE(K)+VWTFV*WE(K)
1199.      C      AUX2=WWTFT*WE(K)

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1200.      C      GT(I,J)=GT(I,J)+AUX1*THETA(L)
1201.      C      GT(I,K)=GT(I,K)+VVTFT*VE(J)*THETA(L)
1202.      C      GT(I,J1)=GT(I,J1)+AUX2*THETA(L)
1203.      C      GT(I,K1)=GT(I,K1)+(VVTFT*VE(J)+WVTFT*WE(J))*THETA(L)
1204.      C      GT(I,L2)=GT(I,L2)+VE(J)*AUX1+WE(J)*AUX2
1205.      C      FTHETA(I)=FTHETA(I)+(VE(J)*AUX1+WE(J)*AUX2)*THETA(L)
1206.      9      CONTINUE
1207.      8      CONTINUE
1208.      7      CONTINUE
1209.      II=-II
1210.      6      CONTINUE
1211.      FSG=0.DO
1212.      DO 10 I=1,NFUNCT
1213.      FSG=FSG+FW(I)**2+FTHETA(I)**2
1214.      10      CONTINUE
1215.      FSG=FSG/2
1216.      DO 4 J=1,NX
1217.      GRAD(J)=0
1218.      DO 5 I=1,NFUNCT
1219.      GRAD(J)=GRAD(J)+FV(I)*GV(I,J)+FW(I)*GW(I,J)+FTHETA(I)*GT(I,J)
1220.      C      5      CONTINUE
1221.      C      4      CONTINUE
1222.      RETURN
1223.      END
1224.      //GO.FTSOF001 DD UNIT=3400-3,VOL=SER-XXXXXX,
1225.      // DISP=(OLD,KEEP),
1226.      // DSN=GALERKIN.NONROTAT.HOVER.COEFFS,LABEL=(4,SL)
1227.      //GO.SYSIN DD *
1228.      /*
1229.      //

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** *****
*                               *
*      COEFFREE                *
*                               *
* *****

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** CALCULATION OF THE GALERKIN COEFFICIENTS FOR THE FLAP-LAG-TORSIONAL MOTION OF A ROTOR BLADE IN HOVER USING THE NON-ROTATING NORMAL MODES OF A CLAMPED-FREE BEAM.

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IMPLICIT REAL*8(A-H,O-Z)
DIMENSION AUX(100),NN(4),Y(11),ALPHA(8),BETA(8)
DIMENSION DELTA(8,8),A(8),B(8),C(8),D(8,8),E(8,8),F(8,8,8),
1 G(8,8,8),H(8,8,8),XI(8,8),XJ(8,8),XK(8,8,8),XM(8,8),XN(8,8),O(8,8)
2 P(8,8),Q(8,8),R(8,8),S(8),AG(8,8,8),BG(8,8,8,8),CG(8,8,8,8),
3 DG(8,8,8),EG(8,8,8,8),FG(8,8,8,8),GG(8,8,8),HG(8,8,8,8),XI(8,8,8,8)
4 XJ(8,8,8),XK(8,8,8),XL(8,8,8),XM(8,8,8),XN(8,8,8),OG(8,8,8,8),
5 PG(8,8,8,8),QG(8,8,8,8),RG(8,8,8,8),SG(8,8,8,8),TG(8,8,8,8),DEL(8,8)
DIMENSION UG(8,8,8),VG(8,8,8),WG(8,8,8),XG(8,8,8),YG(8,8,8),ZG(8,8,8)
1 A4(8,8,8,8),B4(8,8,8,8),C4(8,8,8,8),D4(8,8,8,8),E4(8,8,8,8),
2 F4(8,8,8,8,8),G4(8,8,8,8,8),H4(8,8,8,8,8),XI4(8,8,8,8,8),XJ4(8,8,8,8,8),
3 XL4(8,8,8,8,8),XM4(8,8,8,8,8),XN4(8,8,8,8,8),O4(8,8,8,8,8),P4(8,8,8,8,8),
4 R4(8,8,8,8,8),S4(8,8,8,8,8),T4(8,8,8,8,8),U4(8,8,8,8,8),V4(8,8,8,8,8),W4(8,8,8,8,8)
COMMON ALPHA,BETA
EXTERNAL F13,FCT1,FCT2,FCT3,FCT4,FCT5,FCT6,FCT7,FCT8,FCT9,
1 FCT10,FCT11
C 66 FORMAT(' ',6(D14.7,2X))
C 67 FORMAT(' ',2(D14.7,2X))
C 68 FORMAT(' ',7/)
C 69 FORMAT(' ',3(D14.7,2X))
65 FORMAT('1')
66 FORMAT(' ',7(D14.7,2X))
67 FORMAT(' ',5(D14.7,2X))
68 FORMAT(' ')
69 FORMAT(' ',/)
C 70 FORMAT(' IER1 TO IER20 : ',20(I2,2X))
71 FORMAT(' ALL THE GALERKIN-NONROTAT HOVER COEFFICIENTS WERE PUT ON
1 TAPE NUMBER TO7316 (A PRIVATE TAPE)')
6666 FORMAT(' ',11X,'BETA(1)',22X,'ALPHA(1)',22X,'CH. EQN.')
6667 FORMAT(' ',10X,I2,3X,D25.18,6X,D25.18,6X,D25.18)
C DO 1 I=1,8
C FO(I)=FUNF(O.DO,I)
C FO(I)=O.DO
1 CONTINUE
*****
* THE CONSTANTS ALPHA(I) AND BETA(I) *
*
BETA(1)=1.87510406871196111DO
BETA(2)=4.69409113277417457DO
BETA(3)=7.85475743823761263DO
BETA(4)=10.99554073487546700DO
BETA(5)=14.1371683910464723DO
BETA(6)=17.2787595320882339DO
BETA(7)=20.4203522510412476DO
BETA(8)=23.5619449018064451DO
C** CALCULATION OF THE ALPHA(I) CONSTANTS
C** AND REFINEMENT OF THE B(I)'S BY A MODIFIED EWTON'S METHOD.
WRITE(6,6666)
ERROR=1.D-10
DO 1111 I=1,8
X=BETA(I)
1112 X1=DCOSH(X)
X2=DCOS(X)
FBETA=1.DO+X1*X2
XX=X-.2DO*FBETA/(DSINH(X)*X2-X1*DSIN(X))
TEST=X/XX-1.DO
IF(DABS(TEST).LE.ERROR) GO TO 1113
X=XX
GO TO 1112
1113 X=XX
BETA(I)=X
X1=DCOSH(X)
X2=DCOS(X)

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ORIGINAL PAGE 13
OF POOR QUALITY

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75.      ALPHA(I)=(X1+X2)/(DSINH(X)+DSIN(X))
76.      FBETA=1.DO+X1*X2
77.      WRITE(6,6667) I,X,ALPHA(I),FBETA
78.      1111 CONTINUE
79.      WRITE(6,69)
80.      WRITE(6,69)
81.
82.      *
83.      *****
84.
85.      ERROR=1.D-4
86.      NERROR=100
87.
88.      *****
89.      *** CALCULATION OF THE IJKL-SYMMETRIC 13 COEFFICIENTS
90.      IR1=0
91.      IR2=0
92.      DO 110 I=1,8
93.      DO 111 J=1,8
94.      IF(J.GE.I) GO TO 112
95.      IR1=1
96.      112 DO 113 K=1,8
97.      IF(K.GE.J) GO TO 114
98.      IR2=1
99.      114 DO 115 L=1,8
100.      IF(L.LT.K) GO TO 141
101.      IF(IR1.EQ.0.AND.IR2.EQ.0) GO TO 119
102.      GO TO 141
103.      119 Y(1)=0.DO
104.      NI=1
105.      HH=0.01DO
106.      NCALL=1
107.      CALL BASCRU(0.DO,1.DO,HH,NI,F13,Y,IERJ,AUX,I,J,K,L,NCALL,ERROR,
108.      INERROR)
109.      X13(I,J,K,L)=Y(1)
110.      IF(DABS(X13(I,J,K,L)).LE.1.D-4) X13(I,J,K,L)=0.DO
111.      GO TO 115
112.      C ---- PUT IJKL IN INCREASING ORDER
113.      141 NN(1)=I
114.      NN(2)=J
115.      NN(3)=K
116.      NN(4)=L
117.      IG=I
118.      DO 130 M=2,4
119.      IF(NN(M).GE.IG) GO TO 131
120.      KK=M-1
121.      DO 132 N=1,KK
122.      IF(NN(M).GE.NN(N)) GO TO 132
123.      ITX=NN(N)
124.      NN(N)=NN(M)
125.      NN(M)=ITX
126.      132 CONTINUE
127.      131 IG=NN(M)
128.      130 CONTINUE
129.      M1=NN(1)
130.      M2=NN(2)
131.      M3=NN(3)
132.      M4=NN(4)
133.      X13(I,J,K,L)=X13(M1,M2,M3,M4)
134.      115 CONTINUE
135.      IR2=0
136.      113 CONTINUE
137.      111 IR1=0
138.      110 CONTINUE
139.
140.      C
141.      C
142.      C
143.      C
144.      ***** CALCULATION OF THE --(I,J,K,L) COEFFICIENTS WITH IJ-SYMMETRY
145.      ** M,N,J3,E,K3,DELTA,D,F,G3,N4 : SUBROUTINE FCT1 IS USED
146.      ** Q3,F,G,H,P3,T3,V3,Z3,K : SUBROUTINE FCT2 IS USED
147.      ** R3,S3,Q4,A4 : SUBROUTINE FCT3 IS USED
148.
149.      DO 5 I=1,8
150.      DO 6 J=1,8
151.      NCALL=2
152.      NI=10
153.      Y(1)=0.DO
154.      Y(2)=0.DO

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ORIGINAL PAGE 17
OF POOR QUALITY

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150.      Y(3)=0.DO
151.      Y(4)=0.DO
152.      Y(5)=0.DO
153.      Y(6)=0.DO
154.      Y(7)=0.DO
155.      Y(8)=0.DO
156.      Y(9)=0.DO
157.      Y(10)=0.DO
158.      HH=0.01DO
159.      CALL DASCRI(0.DO,1.DO,HH,NI,FCT1,Y,IER2,AUX,I,J,K,L,NCALL,ERROR,
160.      1NERROR)
161.      DO 991 IA=1,10
162.      IF(DABS(Y(IA)).LE.1.D-4) Y(IA)=0.DO
163. 991 CONTINUE
164.      XM(I,J)=Y(1)
165.      XN(I,J)=Y(2)
166.      XJ3(I,J)=Y(3)
167.      E(I,J)=Y(4)
168.      XK3(I,J)=Y(5)
169.      DELTA(I,J)=Y(6)
170.      IF(I.NE.J) DELTA(I,J)=0.DO
171.      D(I,J)=Y(7)
172.      F(I,J)=Y(8)
173.      IF(I.NE.J) F(I,J)=0.DO
174.      G3(I,J)=Y(9)
175.      XN4(I,J)=Y(10)
176.      DO 7 K=1,8
177.      NCALL=3
178.      NI=10
179.      HH=0.01DO
180.      DO 992 IA=1,10
181.      Y(IA)=0.DO
182. 992 CONTINUE
183.      CALL DASCRI(0.DO,1.DO,HH,NI,FCT2,Y,IER3,AUX,I,J,K,L,NCALL,ERROR,
184.      1NERROR)
185.      DO 993 IA=1,10
186.      IF(DABS(Y(IA)).LE.1.D-4) Y(IA)=0.DO
187. 993 CONTINUE
188.      Q3(I,J,K)=Y(1)
189.      F(I,J,K)=Y(3)/BETA(K)**4
190.      G(I,J,K)=Y(4)
191.      H(I,J,K)=Y(5)
192.      F3(I,J,K)=Y(6)
193.      T3(I,J,K)=Y(7)
194.      V3(I,J,K)=Y(8)
195.      Z3(I,J,K)=Y(9)
196.      XK(I,J,K)=Y(10)
197.      DO 8 L=1,8
198.      NCALL=4
199.      NI=5
200.      HH=0.01DO
201.      Y(1)=0.DO
202.      Y(2)=0.DO
203.      Y(3)=0.DO
204.      Y(4)=0.DO
205.      Y(5)=0.DO
206.      CALL DASCRI(0.DO,1.DO,HH,NI,FCT3,Y,IER4,AUX,I,J,K,L,NCALL,ERROR,
207.      1NERROR)
208.      DO 904 IA=1,5
209.      IF(DABS(Y(IA)).LE.1.D-4) Y(IA)=0.DO
210. 904 CONTINUE
211.      R3(I,J,K,L)=Y(1)
212.      S3(I,J,K,L)=Y(3)
213.      Q4(I,J,K,L)=Y(4)
214.      A4(I,J,K,L)=Y(5)
215.      R3(J,I,K,L)=Y(1)
216.      S3(J,I,K,L)=Y(3)
217.      Q4(J,I,K,L)=Y(4)
218.      A4(J,I,K,L)=Y(5)
219. 8 CONTINUE
220.      Q3(J,I,K)=Q3(I,J,K)
221.      F(J,I,K)=F(I,J,K)
222.      G(J,I,K)=G(I,J,K)
223.      H(J,I,K)=H(I,J,K)
224.      F3(J,I,K)=F3(I,J,K)

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7

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300. DO 15 K=1,8
301. DO 12 L=K,8
302. NCALL=7
303. NI=9
304. HH=0.01DO
305. DO 998 IA=1,9
306. Y(IA)=0.00
307. 998 CONTINUE
308. CALL DASCUR(0.00,1.00,HH,NI,FCT6,Y,IER7,AUX,I,J,K,L,NCALL,ERROR,
309. 1NERROR)
310. DO 999 IA=1,8
311. IF(DABS(Y(IA)).LE.1.D-4) Y(IA)=0.00
312. 999 CONTINUE
313. D4(I,J,K,L)=Y(1).
314. B3(I,K,L,J)=Y(2).
315. F3(I,J,K,L)=Y(3).
316. G4(I,J,K,L)=Y(4).
317. XL4(I,J,K,L)=Y(5).
318. E3(I,J,K,L)=Y(7).
319. H3(I,J,K,L)=Y(8).
320. C *****
321. D4(I,J,L,K)=Y(1).
322. B3(I,L,K,J)=Y(2).
323. F3(I,J,L,K)=Y(3).
324. G4(I,J,L,K)=Y(4).
325. XL4(I,J,L,K)=Y(5).
326. E3(I,J,L,K)=Y(7).
327. H3(I,J,L,K)=Y(8).
328. C *****
329. D4(J,I,K,L)=Y(1).
330. B3(J,K,L,I)=Y(2).
331. F3(J,I,K,L)=Y(3).
332. G4(J,I,K,L)=Y(4).
333. XL4(J,I,K,L)=Y(5).
334. E3(J,I,K,L)=Y(7).
335. H3(J,I,K,L)=Y(8).
336. 16 CONTINUE
337. 15 CONTINUE
338. 14 CONTINUE
339. 13 CONTINUE
340. C
341. C ** / CALCULATION OF THE COEFFICIENTS WITH JKL-SYMMETRY
342. C
343. C ** B4(I,J,K,L),C3(J,I,K,L),E4(J,K,L,I),F4(J,I,K,L) ARE CALCULATED
344. C ** USING SUBROUTINE FCT7
345. C
346. IR=0
347. DO 210 I=1,8
348. DO 211 J=1,8
349. DO 212 K=1,8
350. IF(K.GE.J) GO TO 213
351. IR=1
352. 213 DO 214 L=1,8
353. IF(L.LT.K) GO TO 241
354. IF(IR.EQ.0) GO TO 215
355. GO TO 241
356. 215 NCALL=8
357. NI=4
358. HH=0.01DO
359. Y(1)=0.00
360. Y(2)=0.00
361. Y(3)=0.00
362. Y(4)=0.00
363. CALL DASCUR(0.00,1.00,HH,NI,FCT7,Y,IER8,AUX,I,J,K,L,NCALL,ERROR,
364. 1NERROR)
365. IF(DABS(Y(1)).LE.1.D-4) Y(1)=0.00
366. IF(DABS(Y(2)).LE.1.D-4) Y(2)=0.00
367. IF(DABS(Y(3)).LE.1.D-4) Y(3)=0.00
368. IF(DABS(Y(4)).LE.1.D-4) Y(4)=0.00
369. B4(I,J,K,L)=Y(1)
370. C3(J,I,K,L)=Y(2)
371. E4(J,K,L,I)=Y(3)
372. F4(J,I,K,L)=Y(4)
373. GO TO 214
374. C --- PUT JKL IN INCREASING ORDER

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375. 241 NN(1)=J
376.    NN(2)=K
377.    NN(3)=L
378.    IG=J
379.    DO 216 M=2,3
380.    IF(NN(M).GE.IG) GO TO 217
381.    KK=M-1
382.    DO 218 N=1,KK
383.    IF(NN(M).GE.NN(N)) GO TO 218
384.    ITX=NN(N)
385.    NN(N)=NN(M)
386.    NN(M)=ITX
387. 218 CONTINUE
388. 217 IG=NN(M)
389. 216 CONTINUE
390.    M1=NN(1)
391.    M2=NN(2)
392.    M3=NN(3)
393.    B4(I,J,K,L)=B4(I,M1,M2,M3)
394.    C3(J,I,K,L)=C3(M1,I,M2,M3)
395.    E4(J,K,L,I)=E4(M1,M2,M3,I)
396.    F4(J,I,K,L)=F4(M1,I,M2,M3)
397. 214 CONTINUE
398.    IR=0
399. 212 CONTINUE
400. 211 CONTINUE
401. 210 CONTINUE
402.
403. *** CALCULATION OF THE FOLLOWING NON-SYMMETRIC COEFFICIENTS
404.
405. ** R,D3,L3,K4,T4 : USING SUBROUTINE FCT8
406. ** A3,Y3,J4,M4,W4 : USING SUBROUTINE FCT9
407.    (M4(I,J,K) HAS IK-SYMMETRY, BUT IT WAS LEFT HERE)
408.
409.    DO 25 I=1,8
410.    AUX2=BETA(I)**2
411.    DO 26 J=1,8
412.    BJ2=BETA(J)**2
413.    BJ4=BETA(J)**4
414.    AUX1=AUX2*BJ2
415.    NCALL=9
416.    NI=5
417.    HH=0.01DO
418.    DO 666 IA=1,5
419.    Y(IA)=0.DO
420. 666 CONTINUE
421.    CALL DASCRU(0.DO,1.DO,HH,NI,FCT8,Y,IER9,AUX,I,J,K,L,NCALL,ERROR,
422.    1NERROR)
423.    DO 667 IA=1,5
424.    IF(DABS(Y(IA)).LE.1.D-4) Y(IA)=0.DO
425. 667 CONTINUE
426.    R(I,J)=Y(1)
427.    D3(I,J)=Y(2)
428.    XL3(I,J)=Y(3)
429.    XK4(I,J)=Y(4)
430.    T4(I,J)=Y(5)/BJ4-4.DO/AUX1
431.    IF(DABS(T4(I,J)).LE.1.D-4) T4(I,J)=0.DO
432. 251 DO 27 K=1,8
433.    NCALL=10
434.    NI=6
435.    HH=0.01DO
436.    DO 668 IA=1,6
437.    Y(IA)=0.DO
438. 668 CONTINUE
439.    CALL DASCRU(0.DO,1.DO,HH,NI,FCT9,Y,IER10,AUX,I,J,K,L,NCALL,ERROR,
440.    1NERROR)
441.    DO 669 IA=1,6
442.    IF(DABS(Y(IA)).LE.1.D-4) Y(IA)=0.DO
443. 669 CONTINUE
444.    A3(I,J,K)=Y(1)
445.    Y3(I,J,K)=Y(2)
446.    XJ4(I,J,K)=Y(3)/BJ4-2.DO*Y(4)/BJ2
447.    XM4(I,J,K)=Y(5)/BJ4
448.    W4(I,J,K)=Y(6)/BJ4
449. 27 CONTINUE
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26 CONTINUE
25 CONTINUE

* THE COEFFICIENTS P4,R4,V4 *
*

DO 17 I=1,8
DO 18 J=1,8
DO 19 K=1,8
P4(I,J,K)=-A3(K,J,I)
DO 20 L=1,8
R4(I,J,K,L)=-F3(K,L,I,J)
V4(I,J,K,L)=S3(J,K,L,I)
20 CONTINUE
19 CONTINUE
18 CONTINUE
17 CONTINUE

*

*** CALCULATION OF THE REMAINING COEFFICIENTS

** DEL(I,J) AND
** A,B,C,Q,S,H4,U4 : USING SUBROUTINE FCT10
** I,J,C,M3,W3,Q4 : USING SUBROUTINE FCT11

DO 29 I=1,8
NI=1
IF(I.EQ.1.OR.I.EQ.3.OR.I.EQ.5.OR.I.EQ.7) NI=-1
AUX1=ALPHA(I)/BETA(I)
NCALL=11
NI=7
HH=0.01DO
DO 670 IA=1,7
Y(IA)=0.00
670 CONTINUE
CALL DASCUR(0.00,1.00,HH,NI,FCT10,Y,IER11,AUX,I,J,K,L,NCALL,ERROR,
1 INERROR)
DO 671 IA=1,7
IF(DABS(Y(IA)).LE.1.D-4) Y(IA)=0.00
671 CONTINUE
A(I)=Y(1)
B(I)=Y(2)
C(I)=Y(3)
Q(I)=Y(4)
S(I)=Y(5)
H4(I)=Y(6)
U4(I)=Y(7)
DO 30 J=1,8
NJ=1
IF(J.EQ.1.OR.J.EQ.3.OR.J.EQ.5.OR.J.EQ.7) NJ=-1
NIJ=NI*NJ
BJ2=BETA(J)**2
DEL(I,J)=0.00
IF(I.EQ.J) DEL(I,J)=1.00
NCALL=12
NI=6
HH=0.01DO
DO 672 IA=1,6
Y(IA)=0.00
672 CONTINUE
CALL DASCUR(0.00,1.00,HH,NI,FCT11,Y,IER12,AUX,I,J,K,L,NCALL,ERROR,
1 INERROR)
DO 673 IA=1,6
IF(DABS(Y(IA)).LE.1.D-4) Y(IA)=0.00
673 CONTINUE
XI(I,J)=Y(1)
XJ(I,J)=Y(2)
Q(I,J)=Y(3)
XM3(I,J)=(Y(6)/BJ2-4*AUX1)/BJ2
IF(DABS(XM3(I,J)).LE.1.D-4) XM3(I,J)=0.00
W3(I,J)=Y(4)
Q4(I,J)=Y(5)
30 CONTINUE

```

525. 29 CONTINUE
526. C
527. C ***** CORRECTING XM4(I,J,K) AND W4(I,J,K) : *****
528. C
529. DO 31 I=1,8
530. DO 32 J=1,8
531. BJJ2=BETA(J)**2
532. DO 33 K=1,8
533. XM4(I,J,K)=XM4(I,J,K)-2.DO*DEL(I,K)/BJJ2
534. W4(I,J,K)=W4(I,J,K)-2.DO*Q(I,K)/BJJ2
535. IF(DABS(XM4(I,J,K)).LE.1.D-4) XM4(I,J,K)=0.DO
536. IF(DABS(W4(I,J,K)).LE.1.D-4) W4(I,J,K)=0.DO
537. 33 CONTINUE
538. 32 CONTINUE
539. 31 CONTINUE
540. C
541. C
542. C *****
543. C *
544. C * GO TO 498 IF THE OUTPUT *
545. C * IS NOT TO BE PUT ON TAPE *
546. C *
547. GO TO 498
548. C *
549. C *****
550. C
551. C WRITTING OF THE OUTPUT ON TAPE
552. C
553. DO 400 I=1,8
554. WRITE(50) A(I),B(I),C(I),Q(I),S(I),H4(I),U4(I)
555. 400 CONTINUE
556. DO 411 I=1,8
557. DO 420 J=1,8
558. WRITE(50) DEL(I,J),DELTA(I,J),D(I,J),E(I,J),XI(I,J),XJ(I,J)
559. WRITE(50) XM(I,J),XN(I,J),O(I,J),P(I,J),R(I,J),D3(I,J)
560. WRITE(50) G3(I,J),XJ3(I,J),XK3(I,J),XL3(I,J),XM3(I,J),W3(I,J)
561. WRITE(50) XK4(I,J),XN4(I,J),Q4(I,J),T4(I,J)
562. 420 CONTINUE
563. 411 CONTINUE
564. DO 430 I=1,8
565. DO 440 J=1,8
566. DO 450 K=1,8
567. WRITE(50) F(I,J,K),G(I,J,K),H(I,J,K),XK(I,J,K),A3(I,J,K)
568. 1,XN3(I,J,K)
569. WRITE(50) O3(I,J,K),P3(I,J,K),Q3(I,J,K),T3(I,J,K),U3(I,J,K)
570. 1,V3(I,J,K)
571. WRITE(50) X3(I,J,K),Y3(I,J,K),Z3(I,J,K),XJ4(I,J,K),XM4(I,J,K)
572. 1,P4(I,J,K)
573. WRITE(50) S4(I,J,K),W4(I,J,K)
574. 450 CONTINUE
575. 440 CONTINUE
576. 430 CONTINUE
577. DO 460 I=1,8
578. DO 470 J=1,8
579. DO 480 K=1,8
580. DO 490 L=1,8
581. WRITE(50) B3(I,J,K,L),C3(I,J,K,L),E3(I,J,K,L),F3(I,J,K,L)
582. 1,H3(I,J,K,L),XI3(I,J,K,L)
583. WRITE(50) R3(I,J,K,L),S3(I,J,K,L),A4(I,J,K,L),B4(I,J,K,L)
584. 1,C4(I,J,K,L),D4(I,J,K,L)
585. WRITE(50) E4(I,J,K,L),F4(I,J,K,L),G4(I,J,K,L),XI4(I,J,K,L)
586. 1,XL4(I,J,K,L),Q4(I,J,K,L)
587. WRITE(50) R4(I,J,K,L),V4(I,J,K,L)
588. 490 CONTINUE
589. 480 CONTINUE
590. 470 CONTINUE
591. 460 CONTINUE
592. WRITE(6,71)
593. C *****
594. C *****
595. GO TO 499
596. C *****
597. C *****
598. C *****
599. C *****

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```
C
C 70  FORMAT(' IER1 TO IER20 : ',20(I2,2X))
C  WRITE(6,70) IER1,IER2,IER3,IER4,IER5,IER6,IER7,IER8,IER9,IER10
C  1,IER11,IER12,IER13,IER14,IER15,IER16,IER17,IER18,IER19,IER20
C *****
C
498  WRITE(6,65)
    DO 40 I=5
      WRITE(6,66) A(I),B(I),C(I),Q(I),S(I),H4(I),U4(I)
    40  CONTINUE
      WRITE(6,69)
      DO 41 I=5
        WRITE(6,67) DEL(I,1),DEL(I,2),DEL(I,3),DEL(I,4),DEL(I,5)
      41  CONTINUE
        WRITE(6,68)
        WRITE(6,800)
      800  FORMAT(' DELTA')
        DO 42 I=5
          WRITE(6,67) DELTA(I,1),DELTA(I,2),DELTA(I,3),DELTA(I,4),DELTA(I,5)
        42  CONTINUE
          WRITE(6,68)
          WRITE(6,801)
        801  FORMAT(' D')
          DO 43 I=5
            WRITE(6,67) D(I,1),D(I,2),D(I,3),D(I,4),D(I,5)
          43  CONTINUE
            WRITE(6,68)
            WRITE(6,802)
          802  FORMAT(' E')
            DO 44 I=5
              WRITE(6,67) E(I,1),E(I,2),E(I,3),E(I,4),E(I,5)
            44  CONTINUE
              WRITE(6,68)
              WRITE(6,803)
            803  FORMAT(' I')
              DO 45 I=5
                WRITE(6,67) XI(I,1),XI(I,2),XI(I,3),XI(I,4),XI(I,5)
              45  CONTINUE
                WRITE(6,68)
                WRITE(6,804)
              804  FORMAT(' J')
                DO 46 I=5
                  WRITE(6,67) XJ(I,1),XJ(I,2),XJ(I,3),XJ(I,4),XJ(I,5)
                46  CONTINUE
                  WRITE(6,68)
                  WRITE(6,805)
                805  FORMAT(' M')
                  DO 47 I=5
                    WRITE(6,67) XM(I,1),XM(I,2),XM(I,3),XM(I,4),XM(I,5)
                  47  CONTINUE
                    WRITE(6,68)
                    WRITE(6,806)
                806  FORMAT(' N')
                  DO 48 I=5
                    WRITE(6,67) XN(I,1),XN(I,2),XN(I,3),XN(I,4),XN(I,5)
                  48  CONTINUE
                    WRITE(6,68)
                    WRITE(6,807)
                807  FORMAT(' O')
                  DO 49 I=5
                    WRITE(6,67) O(I,1),O(I,2),O(I,3),O(I,4),O(I,5)
                  49  CONTINUE
                    WRITE(6,65)
                    WRITE(6,808)
                808  FORMAT(' P')
                  DO 50 I=5
                    WRITE(6,67) P(I,1),P(I,2),P(I,3),P(I,4),P(I,5)
                  50  CONTINUE
                    WRITE(6,68)
                    WRITE(6,809)
                809  FORMAT(' R')
                  DO 51 I=5
                    WRITE(6,67) R(I,1),R(I,2),R(I,3),R(I,4),R(I,5)
                  51  CONTINUE
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675. WRITE(6,68)
676. WRITE(6,810)
677. 810 FORMAT(' D3')
678. DO 52 I=5
679. WRITE(6,67) D3(I,1),D3(I,2),D3(I,3),D3(I,4),D3(I,5)
680. 52 CONTINUE
681. WRITE(6,68)
682. WRITE(6,811)
683. 811 FORMAT(' G3')
684. DO 53 I=5
685. WRITE(6,67) G3(I,1),G3(I,2),G3(I,3),G3(I,4),G3(I,5)
686. 53 CONTINUE
687. WRITE(6,68)
688. WRITE(6,812)
689. 812 FORMAT(' J3')
690. DO 54 I=5
691. WRITE(6,67) XJ3(I,1),XJ3(I,2),XJ3(I,3),XJ3(I,4),XJ3(I,5)
692. 54 CONTINUE
693. WRITE(6,68)
694. WRITE(6,813)
695. 813 FORMAT(' K3')
696. DO 55 I=5
697. WRITE(6,67) XK3(I,1),XK3(I,2),XK3(I,3),XK3(I,4),XK3(I,5)
698. 55 CONTINUE
699. WRITE(6,68)
700. WRITE(6,814)
701. 814 FORMAT(' L3')
702. DO 56 I=5
703. WRITE(6,67) XL3(I,1),XL3(I,2),XL3(I,3),XL3(I,4),XL3(I,5)
704. 56 CONTINUE
705. WRITE(6,68)
706. WRITE(6,815)
707. 815 FORMAT(' M3')
708. DO 57 I=5
709. WRITE(6,67) XM3(I,1),XM3(I,2),XM3(I,3),XM3(I,4),XM3(I,5)
710. 57 CONTINUE
711. WRITE(6,68)
712. WRITE(6,816)
713. 816 FORMAT(' W3')
714. DO 58 I=5
715. WRITE(6,67) W3(I,1),W3(I,2),W3(I,3),W3(I,4),W3(I,5)
716. 58 CONTINUE
717. WRITE(6,68)
718. WRITE(6,817)
719. 817 FORMAT(' K4')
720. DO 59 I=5
721. WRITE(6,67) XK4(I,1),XK4(I,2),XK4(I,3),XK4(I,4),XK4(I,5)
722. 59 CONTINUE
723. WRITE(6,68)
724. WRITE(6,818)
725. 818 FORMAT(' N4')
726. DO 60 I=5
727. WRITE(6,67) XN4(I,1),XN4(I,2),XN4(I,3),XN4(I,4),XN4(I,5)
728. 60 CONTINUE
729. WRITE(6,68)
730. WRITE(6,819)
731. 819 FORMAT(' O4')
732. DO 61 I=5
733. WRITE(6,67) O4(I,1),O4(I,2),O4(I,3),O4(I,4),O4(I,5)
734. 61 CONTINUE
735. WRITE(6,68)
736. WRITE(6,820)
737. 820 FORMAT(' T4')
738. DO 62 I=5
739. WRITE(6,67) T4(I,1),T4(I,2),T4(I,3),T4(I,4),T4(I,5)
740. 62 CONTINUE
741. WRITE(6,68)
742. WRITE(6,821)
743. 821 FORMAT(' F')
744. DO 501 I=5
745. DO 502 J=1,5
746. WRITE(6,67) F(I,J,1),F(I,J,2),F(I,J,3),F(I,J,4),F(I,J,5)
747. 502 CONTINUE
748. WRITE(6,68)
749. 501 CONTINUE
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750.      WRITE(4,822)
751.      822 FORMAT(' G')
752.      DO 503 I=5
753.      DO 504 J=1,5
754.      WRITE(4,67) G(I,J,1),G(I,J,2),G(I,J,3),G(I,J,4),G(I,J,5)
755.      504 CONTINUE
756.      WRITE(4,68)
757.      503 CONTINUE
758.      WRITE(4,65)
759.      WRITE(4,823)
760.      823 FORMAT(' H')
761.      DO 505 I=5
762.      DO 506 J=1,5
763.      WRITE(4,67) H(I,J,1),H(I,J,2),H(I,J,3),H(I,J,4),H(I,J,5)
764.      506 CONTINUE
765.      WRITE(4,68)
766.      505 CONTINUE
767.      WRITE(4,824)
768.      824 FORMAT(' K')
769.      DO 507 I=5
770.      DO 508 J=1,5
771.      WRITE(4,67) XK(I,J,1),XK(I,J,2),XK(I,J,3),XK(I,J,4),XK(I,J,5)
772.      508 CONTINUE
773.      WRITE(4,68)
774.      507 CONTINUE
775.      WRITE(4,65)
776.      WRITE(4,825)
777.      825 FORMAT(' A3')
778.      DO 509 I=5
779.      DO 510 J=1,5
780.      WRITE(4,67) A3(I,J,1),A3(I,J,2),A3(I,J,3),A3(I,J,4),A3(I,J,5)
781.      510 CONTINUE
782.      WRITE(4,68)
783.      509 CONTINUE
784.      WRITE(4,826)
785.      826 FORMAT(' N3')
786.      DO 511 I=5
787.      DO 512 J=1,5
788.      WRITE(4,67) XN3(I,J,1),XN3(I,J,2),XN3(I,J,3),XN3(I,J,4),XN3(I,J,4)
789.      512 CONTINUE
790.      WRITE(4,68)
791.      511 CONTINUE
792.      WRITE(4,65)
793.      WRITE(4,827)
794.      827 FORMAT(' O3')
795.      DO 513 I=5
796.      DO 514 J=1,5
797.      WRITE(4,67) O3(I,J,1),O3(I,J,2),O3(I,J,3),O3(I,J,4),O3(I,J,5)
798.      514 CONTINUE
799.      WRITE(4,68)
800.      513 CONTINUE
801.      WRITE(4,828)
802.      828 FORMAT(' P3')
803.      DO 515 I=5
804.      DO 516 J=1,5
805.      WRITE(4,67) P3(I,J,1),P3(I,J,2),P3(I,J,3),P3(I,J,4),P3(I,J,5)
806.      516 CONTINUE
807.      WRITE(4,68)
808.      515 CONTINUE
809.      WRITE(4,65)
810.      WRITE(4,829)
811.      829 FORMAT(' Q3')
812.      DO 517 I=5
813.      DO 518 J=1,5
814.      WRITE(4,67) Q3(I,J,1),Q3(I,J,2),Q3(I,J,3),Q3(I,J,4),Q3(I,J,5)
815.      518 CONTINUE
816.      WRITE(4,68)
817.      517 CONTINUE
818.      WRITE(4,830)
819.      830 FORMAT(' T3')
820.      DO 519 I=5
821.      DO 520 J=1,5
822.      WRITE(4,67) T3(I,J,1),T3(I,J,2),T3(I,J,3),T3(I,J,4),T3(I,J,5)
823.      520 CONTINUE
824.      WRITE(4,68)

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825.      519 CONTINUE
826.      WRITE(6,65)
827.      WRITE(6,8310)
828.      8310 FORMAT(' U3')
829.      DO 521 I=5
830.      DO 522 J=1,5
831.      WRITE(6,67) U3(I,J,1),U3(I,J,2),U3(I,J,3),U3(I,J,4),U3(I,J,5)
832.      522 CONTINUE
833.      WRITE(6,68)
834.      521 CONTINUE
835.      WRITE(6,831)
836.      831 FORMAT(' V3')
837.      DO 523 I=5
838.      DO 524 J=1,5
839.      WRITE(6,67) V3(I,J,1),V3(I,J,2),V3(I,J,3),V3(I,J,4),V3(I,J,5)
840.      524 CONTINUE
841.      WRITE(6,68)
842.      523 CONTINUE
843.      WRITE(6,65)
844.      WRITE(6,832)
845.      832 FORMAT(' X3')
846.      DO 525 I=5
847.      DO 526 J=1,5
848.      WRITE(6,67) X3(I,J,1),X3(I,J,2),X3(I,J,3),X3(I,J,4),X3(I,J,5)
849.      526 CONTINUE
850.      WRITE(6,68)
851.      525 CONTINUE
852.      WRITE(6,833)
853.      833 FORMAT(' Y3')
854.      DO 527 I=5
855.      DO 528 J=1,5
856.      WRITE(6,67) Y3(I,J,1),Y3(I,J,2),Y3(I,J,3),Y3(I,J,4),Y3(I,J,5)
857.      528 CONTINUE
858.      WRITE(6,68)
859.      527 CONTINUE
860.      WRITE(6,65)
861.      WRITE(6,834)
862.      834 FORMAT(' Z3')
863.      DO 529 I=5
864.      DO 530 J=1,5
865.      WRITE(6,67) Z3(I,J,1),Z3(I,J,2),Z3(I,J,3),Z3(I,J,4),Z3(I,J,5)
866.      530 CONTINUE
867.      WRITE(6,68)
868.      529 CONTINUE
869.      WRITE(6,835)
870.      835 FORMAT(' J4')
871.      DO 531 I=5
872.      DO 532 J=1,5
873.      WRITE(6,67) XJ4(I,J,1),XJ4(I,J,2),XJ4(I,J,3),XJ4(I,J,4),XJ4(I,J,5)
874.      532 CONTINUE
875.      WRITE(6,68)
876.      531 CONTINUE
877.      WRITE(6,65)
878.      WRITE(6,836)
879.      836 FORMAT(' M4')
880.      DO 533 I=5
881.      DO 534 J=1,5
882.      WRITE(6,67) XM4(I,J,1),XM4(I,J,2),XM4(I,J,3),XM4(I,J,4),XM4(I,J,5)
883.      534 CONTINUE
884.      WRITE(6,68)
885.      533 CONTINUE
886.      WRITE(6,837)
887.      837 FORMAT(' P4')
888.      DO 535 I=5
889.      DO 536 J=1,5
890.      WRITE(6,67) P4(I,J,1),P4(I,J,2),P4(I,J,3),P4(I,J,4),P4(I,J,5)
891.      536 CONTINUE
892.      WRITE(6,68)
893.      535 CONTINUE
894.      WRITE(6,65)
895.      WRITE(6,838)
896.      838 FORMAT(' S4')
897.      DO 537 I=5
898.      DO 538 J=1,5
899.      WRITE(6,67) S4(I,J,1),S4(I,J,2),S4(I,J,3),S4(I,J,4),S4(I,J,5)

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900. 538 CONTINUE
901. WRITE(6,68)
902. 537 CONTINUE
903. WRITE(6,839)
904. 839 FORMAT(' W4')
905. DO 539 I=5
906. DO 540 J=1,5
907. WRITE(6,67) W4(I,J,1),W4(I,J,2),W4(I,J,3),W4(I,J,4),W4(I,J,5)
908. 540 CONTINUE
909. WRITE(6,68)
910. 539 CONTINUE
911. WRITE(6,65)
912. WRITE(6,840)
913. 840 FORMAT(' B3')
914. DO 541 I=5
915. DO 542 J=1,5
916. DO 543 K=1,5
917. WRITE(6,67) B3(I,J,K,1),B3(I,J,K,2),B3(I,J,K,3),B3(I,J,K,4)
918. 1,B3(I,J,K,5)
919. 543 CONTINUE
920. WRITE(6,68)
921. 542 CONTINUE
922. IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
923. IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
924. 541 CONTINUE
925. WRITE(6,65)
926. WRITE(6,841)
927. 841 FORMAT(' C3')
928. DO 544 I=5
929. DO 545 J=1,5
930. DO 546 K=1,5
931. WRITE(6,67) C3(I,J,K,1),C3(I,J,K,2),C3(I,J,K,3),C3(I,J,K,4)
932. 1,C3(I,J,K,5)
933. 546 CONTINUE
934. WRITE(6,68)
935. 545 CONTINUE
936. IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
937. IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
938. 544 CONTINUE
939. WRITE(6,65)
940. WRITE(6,842)
941. 842 FORMAT(' E3')
942. DO 547 I=5
943. DO 548 J=1,5
944. DO 549 K=1,5
945. WRITE(6,67) E3(I,J,K,1),E3(I,J,K,2),E3(I,J,K,3),E3(I,J,K,4)
946. 1,E3(I,J,K,5)
947. 549 CONTINUE
948. IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
949. IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
950. 548 CONTINUE
951. 547 CONTINUE
952. WRITE(6,65)
953. WRITE(6,843)
954. 843 FORMAT(' F3')
955. DO 550 I=5
956. DO 551 J=1,5
957. DO 552 K=1,5
958. WRITE(6,67) F3(I,J,K,1),F3(I,J,K,2),F3(I,J,K,3),F3(I,J,K,4)
959. 1,F3(I,J,K,5)
960. 552 CONTINUE
961. WRITE(6,68)
962. 551 CONTINUE
963. IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
964. IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
965. 550 CONTINUE
966. WRITE(6,65)
967. WRITE(6,844)
968. 844 FORMAT(' H3')
969. DO 553 I=5
970. DO 554 J=1,5
971. DO 555 K=1,5
972. WRITE(6,67) H3(I,J,K,1),H3(I,J,K,2),H3(I,J,K,3),H3(I,J,K,4)
973. 1,H3(I,J,K,5)
974. 555 CONTINUE
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975.      WRITE(6,68)
976. 554 CONTINUE
977.      IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
978.      IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
979. 553 CONTINUE
980.      WRITE(6,65)
981.      WRITE(6,845)
982. 845 FORMAT(' I3')
983.      DO 556 I=5
984.      DO 557 J=1,5
985.      DO 558 K=1,5
986.      WRITE(6,67) XI3(I,J,K,1),XI3(I,J,K,2),XI3(I,J,K,3)
987. 1,XI3(I,J,K,4),XI3(I,J,K,5)
988. 558 CONTINUE
989.      WRITE(6,68)
990. 557 CONTINUE
991.      IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
992.      IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
993. 556 CONTINUE
994.      WRITE(6,65)
995.      WRITE(6,846)
996. 846 FORMAT(' R3')
997.      DO 559 I=5
998.      DO 560 J=1,5
999.      DO 561 K=1,5
1000.      WRITE(6,67) R3(I,J,K,1),R3(I,J,K,2),R3(I,J,K,3),R3(I,J,K,4)
1001. 1,R3(I,J,K,5)
1002. 561 CONTINUE
1003.      WRITE(6,68)
1004. 560 CONTINUE
1005.      IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
1006.      IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
1007. 559 CONTINUE
1008.      WRITE(6,65)
1009.      WRITE(6,847)
1010. 847 FORMAT(' S3')
1011.      DO 562 I=5
1012.      DO 563 J=1,5
1013.      DO 564 K=1,5
1014.      WRITE(6,67) S3(I,J,K,1),S3(I,J,K,2),S3(I,J,K,3),S3(I,J,K,4)
1015. 1,S3(I,J,K,5)
1016. 564 CONTINUE
1017.      WRITE(6,68)
1018. 563 CONTINUE
1019.      IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
1020.      IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
1021. 562 CONTINUE
1022.      WRITE(6,65)
1023.      WRITE(6,848)
1024. 848 FORMAT(' A4')
1025.      DO 565 I=5
1026.      DO 566 J=1,5
1027.      DO 567 K=1,5
1028.      WRITE(6,67) A4(I,J,K,1),A4(I,J,K,2),A4(I,J,K,3),A4(I,J,K,4)
1029. 1,A4(I,J,K,5)
1030. 567 CONTINUE
1031.      WRITE(6,68)
1032. 566 CONTINUE
1033.      IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
1034.      IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
1035. 565 CONTINUE
1036.      WRITE(6,65)
1037.      WRITE(6,849)
1038. 849 FORMAT(' B4')
1039.      DO 568 I=5
1040.      DO 569 J=1,5
1041.      DO 570 K=1,5
1042.      WRITE(6,67) B4(I,J,K,1),B4(I,J,K,2),B4(I,J,K,3),B4(I,J,K,4)
1043. 1,B4(I,J,K,5)
1044. 570 CONTINUE
1045.      WRITE(6,68)
1046. 569 CONTINUE
1047.      IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
1048.      IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
1049. 568 CONTINUE
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1050. WRITE(6,65)
1051. WRITE(6,850)
1052. 850. FORMAT(' C4')
1053. DO 571 I=5
1054. DO 572 J=1,5
1055. DO 573 K=1,5
1056. WRITE(6,67) C4(I,J,K,1),C4(I,J,K,2),C4(I,J,K,3),C4(I,J,K,4)
1057. 1,C4(I,J,K,5)
1058. 573. CONTINUE
1059. WRITE(6,68)
1060. 572. CONTINUE
1061. IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
1062. IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
1063. 571. CONTINUE
1064. WRITE(6,65)
1065. WRITE(6,851)
1066. 851. FORMAT(' D4')
1067. DO 574 I=5
1068. DO 575 J=1,5
1069. DO 576 K=1,5
1070. WRITE(6,67) D4(I,J,K,1),D4(I,J,K,2),D4(I,J,K,3),D4(I,J,K,4),
1071. 1,D4(I,J,K,5)
1072. 576. CONTINUE
1073. WRITE(6,68)
1074. 575. CONTINUE
1075. IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
1076. IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
1077. 574. CONTINUE
1078. WRITE(6,65)
1079. WRITE(6,852)
1080. 852. FORMAT(' E4')
1081. DO 577 I=5
1082. DO 578 J=1,5
1083. DO 579 K=1,5
1084. WRITE(6,67) E4(I,J,K,1),E4(I,J,K,2),E4(I,J,K,3),E4(I,J,K,4)
1085. 1,E4(I,J,K,5)
1086. 579. CONTINUE
1087. WRITE(6,68)
1088. 578. CONTINUE
1089. IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
1090. IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
1091. 577. CONTINUE
1092. WRITE(6,65)
1093. WRITE(6,853)
1094. 853. FORMAT(' F4')
1095. DO 580 I=5
1096. DO 581 J=1,5
1097. DO 582 K=1,5
1098. WRITE(6,67) F4(I,J,K,1),F4(I,J,K,2),F4(I,J,K,3),F4(I,J,K,4)
1099. 1,F4(I,J,K,5)
1100. 582. CONTINUE
1101. WRITE(6,68)
1102. 581. CONTINUE
1103. IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
1104. IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
1105. 580. CONTINUE
1106. WRITE(6,65)
1107. WRITE(6,854)
1108. 854. FORMAT(' G4')
1109. DO 583 I=5
1110. DO 584 J=1,5
1111. DO 585 K=1,5
1112. WRITE(6,67) G4(I,J,K,1),G4(I,J,K,2),G4(I,J,K,3),G4(I,J,K,4)
1113. 1,G4(I,J,K,5)
1114. 585. CONTINUE
1115. WRITE(6,68)
1116. 584. CONTINUE
1117. IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
1118. IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
1119. 583. CONTINUE
1120. WRITE(6,65)
1121. WRITE(6,855)
1122. 855. FORMAT(' I4')
1123. DO 586 I=5
1124. DO 587 J=1,5
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1125.      DO 588 K=1,5
1126.      WRITE(6,67) XI4(I,J,K,1),XI4(I,J,K,2),XI4(I,J,K,3)
1127.      1,XI4(I,J,K,4),XI4(I,J,K,5)
1128. 588 CONTINUE
1129.      WRITE(6,68)
1130. 587 CONTINUE
1131.      IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
1132.      IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
1133. 586 CONTINUE
1134.      WRITE(6,65)
1135.      WRITE(6,856)
1136. 856 FORMAT(' L4')
1137.      DO 589 I=5
1138.      DO 590 J=1,5
1139.      DO 591 K=1,5
1140.      WRITE(6,67) XL4(I,J,K,1),XL4(I,J,K,2),XL4(I,J,K,3),XL4(I,J,K,4)
1141.      1,XL4(I,J,K,5)
1142. 591 CONTINUE
1143.      WRITE(6,68)
1144. 590 CONTINUE
1145.      IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
1146.      IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
1147. 589 CONTINUE
1148.      WRITE(6,65)
1149.      WRITE(6,857)
1150. 857 FORMAT(' Q4')
1151.      DO 592 I=5
1152.      DO 593 J=1,5
1153.      DO 594 K=1,5
1154.      WRITE(6,67) Q4(I,J,K,1),Q4(I,J,K,2),Q4(I,J,K,3),Q4(I,J,K,4)
1155.      1,Q4(I,J,K,5)
1156. 594 CONTINUE
1157.      WRITE(6,68)
1158. 593 CONTINUE
1159.      IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
1160.      IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
1161. 592 CONTINUE
1162.      WRITE(6,65)
1163.      WRITE(6,858)
1164. 858 FORMAT(' R4')
1165.      DO 595 I=5
1166.      DO 596 J=1,5
1167.      DO 597 K=1,5
1168.      WRITE(6,67) R4(I,J,K,1),R4(I,J,K,2),R4(I,J,K,3),R4(I,J,K,4)
1169.      1,R4(I,J,K,5)
1170. 597 CONTINUE
1171.      WRITE(6,68)
1172. 596 CONTINUE
1173.      IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
1174.      IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
1175. 595 CONTINUE
1176.      WRITE(6,65)
1177.      WRITE(6,859)
1178. 859 FORMAT(' V4')
1179.      DO 598 I=5
1180.      DO 599 J=1,5
1181.      DO 600 K=1,5
1182.      WRITE(6,67) V4(I,J,K,1),V4(I,J,K,2),V4(I,J,K,3),V4(I,J,K,4)
1183.      1,V4(I,J,K,5)
1184. 600 CONTINUE
1185.      WRITE(6,68)
1186. 599 CONTINUE
1187.      IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
1188.      IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
1189. 598 CONTINUE
1190. 499 STOP
1191. END
1192. FUNCTION FUNF(X,N)
1193. REAL*8 X,XX,ALPHA,BETA,FUNF,DCOSH,DCOS,DSINH,DSIN
1194. DIMENSION ALPHA(8),BETA(8)
1195. COMMON ALPHA,BETA
1196. XX=X*BETA(N)
1197. FUNF=DCOSH(XX)-DCOS(XX)-ALPHA(N)*(DSINH(XX)-DSIN(XX))
1198. RETURN
1199. END

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1200. FUNCTION FUNFP(X,N)
1201. REAL*8 FUNFP,X,XX,ALPHA,BETA,DCOSH,DCOS,DSINH,DSIN
1202. DIMENSION ALPHA(8),BETA(8)
1203. COMMON ALPHA,BETA
1204. XX=X*BETA(N)
1205. FUNFP=BETA(N)*(DSINH(XX)+DSIN(XX)-ALPHA(N)*(DCOSH(XX)-DCOS(XX)))
1206. RETURN
1207. END
1208. FUNCTION FUNFPP(X,N)
1209. REAL*8 FUNFPP,X,XX,ALPHA,BETA,DCOSH,DCOS,DSINH,DSIN
1210. DIMENSION ALPHA(8),BETA(8)
1211. COMMON ALPHA,BETA
1212. XX=X*BETA(N)
1213. FUNFPP=(BETA(N)**2)*(DCOSH(XX)+DCOS(XX)-ALPHA(N)*(DSINH(XX)
1214. 1+DSIN(XX)))
1215. RETURN
1216. END
1217. FUNCTION FUNF3P(X,N)
1218. REAL*8 FUNF3P,X,XX,ALPHA,BETA,DCOSH,DCOS,DSINH,DSIN
1219. DIMENSION ALPHA(8),BETA(8)
1220. COMMON ALPHA,BETA
1221. XX=X*BETA(N)
1222. FUNF3P=(BETA(N)**3)*(DSINH(XX)-DSIN(XX)-ALPHA(N)*(DCOSH(XX)
1223. 1+DCOS(XX)))
1224. RETURN
1225. END
1226. FUNCTION FUNG(X,N)
1227. REAL*8 FUNG,X,DSIN,XA
1228. XA=(2*N-1)*X*1.570796327D0
1229. FUNG=DSIN(XA)*1.414213562D0
1230. RETURN
1231. END
1232. FUNCTION FUNGP(X,N)
1233. REAL*8 FUNGP,X,A,DCOS,XA
1234. A=(2*N-1)*1.570796327D0
1235. FUNGP=A*DCOS(A*X)*1.414213562D0
1236. RETURN
1237. END
1238. FUNCTION FUNGPP(X,N)
1239. REAL*8 FUNGPP,X,XA,FUNG
1240. XA=((2*N-1)*1.570796327D0)**2
1241. FUNGPP=-XA*FUNG(X,N)
1242. RETURN
1243. END
1244. SUBROUTINE FIG(Y,X,N,DY,I,J,K,L)
1245. REAL*8 X,Y,DY,FUNFP
1246. DIMENSION Y(2),DY(2)
1247. DY(1)=(X**2-1)*FUNFP(X,I)*FUNFP(X,J)*FUNFP(X,K)*FUNFP(X,L)
1248. RETURN
1249. END
1250. SUBROUTINE FCT1(Y,X,N,DY,I,J,K,L)
1251. REAL*8 X,Y,DY,XX,XX1,XX2,XX3,FUNF,FUNFP,FUNFPP,FUNF3P,FUNG,FUNGP
1252. DIMENSION Y(10),DY(10)
1253. DY(1)=X*FUNG(X,I)*FUNG(X,J)
1254. XX=X**2
1255. XX1=X*FUNF(X,I)*FUNF(X,J)
1256. XX2=FUNFP(X,I)*FUNFP(X,J)
1257. XX3=FUNGP(X,I)*FUNGP(X,J)
1258. DY(2)=(1-XX)*XX3/2
1259. DY(4)=XX1
1260. DY(5)=-XX2
1261. DY(6)=FUNFPP(X,I)*FUNFPP(X,J)
1262. DY(7)=(1-XX)*XX2
1263. DY(3)=-((1-XX)*DY(7))
1264. DY(8)=-XX3
1265. DY(9)=(XX-5)*DY(7)
1266. DY(7)=DY(7)/2
1267. DY(10)=(1-XX/3)*XX1
1268. RETURN
1269. END
1270. SUBROUTINE FCT2(Y,X,N,DY,I,J,K,L)
1271. REAL*8 X,Y,DY,XX1,XX3,XX4,XX5,FUNF,FUNFP,FUNFPP,FUNF3P,FUNG,FUNGP
1272. DIMENSION Y(10),DY(10)
1273. XX1=FUNFP(X,I)*FUNFP(X,J)
1274. XX3=FUNF(X,I)*FUNF(X,J)

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1275. XX4=FUNG(X,K)
1276. XX5=FUNFP(X,K)
1277. DY(1)=X*XX*XX5*Y(2)
1278. DY(2)=XX1
1279. DY(3)=-XX1*FUNF3P(X,K)
1280. DY(5)=XX3*XX4
1281. DY(4)=X*DY(5)
1282. DY(6)=X*XX5*Y(2)
1283. DY(9)=XX3*XX5
1284. DY(7)=X*DY(9)
1285. DY(8)=XX3*FUNF(X,K)
1286. DY(10)=XX4*FUNFPP(X,I)*FUNFPP(X,J)
1287. RETURN
1288. END
1289. SUBROUTINE FCT3(Y,X,N,DY,I,J,K,L)
1290. REAL*8 X,Y,DY,XX1,XX2,XX3,FUNF,FUNFP,FUNFPP,FUNF3P,FUNG,FUNGP
1291. DIMENSION Y(5),DY(5)
1292. XX1=FUNFP(X,I)*FUNFP(X,J)
1293. XX2=FUNFP(X,K)
1294. XX3=FUNG(X,L)
1295. DY(1)=X*XX*XX2*XX3*Y(2)
1296. DY(2)=XX1
1297. DY(3)=X*XX2*FUNF(X,L)*Y(2)
1298. DY(4)=-XX1*(XX2*FUNF3P(X,L)+FUNFPP(X,K)*FUNFPP(X,L))
1299. DY(5)=X*FUNF(X,I)*FUNF(X,J)*XX2*XX3
1300. RETURN
1301. END
1302. SUBROUTINE FCT4(Y,X,N,DY,I,J,K,L)
1303. REAL*8 X,Y,DY,XX1,XX2,FUNF,FUNFP,FUNFPP,FUNF3P,FUNG,FUNGP
1304. DIMENSION Y(6),DY(6)
1305. XX1=X*FUNF(X,I)
1306. XX2=FUNFP(X,J)*FUNFP(X,K)
1307. DY(3)=XX1*XX2
1308. DY(1)=X*DY(3)
1309. DY(4)=XX1*FUNG(X,J)*FUNG(X,K)
1310. DY(2)=X*DY(4)
1311. DY(5)=XX1*Y(6)
1312. DY(6)=XX2
1313. RETURN
1314. END
1315. SUBROUTINE FCT5(Y,X,N,DY,I,J,K,L)
1316. REAL*8 X,Y,DY,FUNF,FUNFP,FUNG
1317. DIMENSION Y(3),DY(3)
1318. DY(2)=FUNFP(X,J)*FUNFP(X,K)
1319. DY(3)=X*FUNF(X,I)*FUNG(X,L)
1320. DY(1)=Y(2)*DY(3)
1321. DY(3)=X*DY(3)*DY(2)
1322. RETURN
1323. END
1324. SUBROUTINE FCT6(Y,X,N,DY,I,J,K,L)
1325. REAL*8 X,Y,DY,FUNF,FUNFP,FUNFPP,FUNF3P,FUNG,FUNGP
1326. 1,XX,XX1,XX2,XX3,XX4,XX5,XX6
1327. DIMENSION Y(9),DY(9)
1328. XX=FUNG(X,K)*FUNG(X,L)
1329. XX1=FUNFP(X,I)
1330. XX2=FUNFP(X,J)
1331. XX3=FUNFPP(X,I)
1332. XX4=FUNFPP(X,J)
1333. XX5=FUNFP(X,K)
1334. XX6=FUNFP(X,L)
1335. DY(1)=FUNF(X,I)*FUNF(X,J)
1336. DY(2)=XX3*XX4
1337. DY(6)=XX5*XX6
1338. DY(9)=XX1*XX2
1339. DY(3)=DY(2)*DY(6)
1340. DY(2)=DY(2)*XX-
1341. DY(8)=Y(9)*Y(6)
1342. DY(5)=DY(1)*Y(6)
1343. DY(4)=X*DY(1)
1344. DY(1)=DY(4)*XX
1345. DY(4)=DY(4)*DY(6)
1346. DY(7)=(XX2*XX3+XX1*XX4)*(XX6*FUNFPP(X,K)+XX5*FUNFPP(X,L))
1347. RETURN
1348. END
1349. SUBROUTINE FCT7(Y,X,N,DY,I,J,K,L)

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1350. REAL*8 X,Y,DY,XX,FUNF,FUNG,FUNFP,FUNFP3P
1351. DIMENSION Y(4),DY(4)
1352. XX=FUNF(X,J)
1353. DY(1)=X*XX*FUNF(X,I)*FUNG(X,J)*FUNG(X,K)*FUNG(X,L)
1354. DY(2)=-FUNFP(X,J)*FUNFP3P(X,I)*FUNFP(X,K)*FUNFP(X,L)/2
1355. DY(3)=FUNF(X,K)*FUNF(X,L)
1356. DY(4)=XX*FUNFP(X,I)*DY(3)
1357. DY(3)=XX*DY(3)*FUNG(X,I)
1358. RETURN
1359. END
1360. SUBROUTINE FCT8(Y,X,N,DY,I,J,K,L)
1361. REAL*8 X,Y,DY,XX,XX1,XX2,XX3,XX4,FUNG,FUNF,FUNFP,FUNFP3P,FUNFP3P
1362. DIMENSION Y(5),DY(5)
1363. XX=X**2
1364. XX1=FUNFP(X,J)
1365. XX2=FUNFP(X,I)
1366. XX3=FUNG(X,I)
1367. XX4=FUNFP3P(X,J)
1368. DY(1)=X*XX1*FUNG(X,I)
1369. DY(2)=3*XX2*((1-XX)*FUNFP3P(X,J)-2*X*XX4)/2-XX1*XX2
1370. DY(3)=FUNG(X,J)
1371. DY(4)=XX*(1-XX/3)*XX3*DY(3)
1372. DY(5)=-XX2*DY(3)
1373. DY(5)=X*XX3*XX4
1374. RETURN
1375. END
1376. SUBROUTINE FCT9(Y,X,N,DY,I,J,K,L)
1377. REAL*8 X,Y,DY,FUNF,FUNFP,FUNFP3P,FUNG,FUNG3P
1378. DIMENSION Y(6),DY(6)
1379. DY(6)=FUNF(X,I)
1380. DY(4)=X*DY(6)*FUNG(X,K)
1381. DY(2)=DY(4)*FUNFP(X,J)
1382. DY(1)=FUNFP(X,K)
1383. DY(3)=FUNFP3P(X,J)
1384. DY(5)=DY(6)*DY(3)
1385. DY(5)=DY(5)*FUNF(X,K)
1386. DY(5)=X*DY(5)*DY(1)
1387. DY(3)=DY(3)*DY(4)
1388. DY(1)=DY(1)*FUNFP3P(X,I)*FUNG3P(X,J)
1389. RETURN
1390. END
1391. SUBROUTINE FCT10(Y,X,N,DY,I,J,K,L)
1392. REAL*8 X,Y,DY,XX,XX1,XX2,FUNF,FUNFP,FUNG
1393. DIMENSION Y(7),DY(7)
1394. XX=X**2
1395. XX1=FUNF(X,I)
1396. XX2=FUNG(X,I)
1397. DY(1)=XX1
1398. DY(2)=X*XX1
1399. DY(3)=XX*XX1
1400. DY(4)=XX2
1401. DY(5)=X*XX2
1402. DY(6)=X*(3-XX)*XX1/3
1403. DY(7)=-(X**5-5*X**3+4)*FUNFP(X,I)/15
1404. RETURN
1405. END
1406. SUBROUTINE FCT11(Y,X,N,DY,I,J,K,L)
1407. REAL*8 X,Y,DY,XX1,XX2,XX3,XX4,FUNF,FUNFP,FUNFP3P,FUNG
1408. DIMENSION Y(6),DY(6)
1409. XX1=FUNF(X,I)
1410. XX2=XX1*FUNG(X,J)
1411. XX3=XX1*FUNFP(X,J)
1412. XX4=FUNG(X,J)
1413. DY(1)=X*XX2
1414. DY(2)=X*DY(1)
1415. DY(3)=X*XX3
1416. DY(4)=XX3
1417. DY(5)=XX2
1418. DY(6)=XX1*FUNFP3P(X,J)
1419. RETURN
1420. END
1421. SUBROUTINE DASCRU(A,B,H,N,F,XO,IER,WK,K,L,M,NN,NCALL,EG,NEERRR)
1422. C
1423. DIMENSION WK(1),XO(1)
1424. INTEGER SW

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1425. LOGICAL BE, BH, BR, BX
1426. C
1427. C*****
1428. C***
1429. C*** E5 SHOULD BE SET TO .5 TIMES THE DESIRED RELATIVE
1430. C*** PRECISION OF THE SOLUTION
1431. C***
1432. C*****
1433. REAL*8 DSIGN, DABS
1434. DOUBLE PRECISION A, B, H, XO, WK, HMIN, X, XS, Q, H3, R, E, E5, ZERO,
1435. * P5, OP5, THREE, FOUR, HS
1436. * DATA ZERO, P5, OP5, THREE, FOUR/O, DO, .5DO, 1.5DO,
1437. * 3.DO, 4.DO/
1438. IER = 0
1439. IF(A.EQ.B) GO TO 100
1440. IB1=N+N
1441. IB2=IB1+N
1442. HMIN=DABS(H)/NERROR
1443. BH=.TRUE.
1444. BR=.TRUE.
1445. EX=.TRUE.
1446. C CHECK FOR THE PROPER SIGN OF H
1447. H=DSIGN(DABS(H), B-A)
1448. X=A
1449. 5 XS=X
1450. DO 10 J=1, N
1451. IJKO=N+J
1452. WK(IJKO)=XO(J)
1453. 10 CONTINUE
1454. 15 HS=H
1455. Q=X+H-B
1456. BE=.TRUE.
1457. IF(.NOT.((H.GT.ZERO.AND.Q.GE.ZERO).OR.(H.LT.ZERO.AND.Q.LE.ZERO)))
1458. 1 GO TO 20
1459. H=B-X
1460. BR=.FALSE.
1461. 20 H3=H/THREE
1462. C CALCULATE SOLN. AT X+H.
1463. DO 90 SW=1,5
1464. CALL F(XO, X, N, WK, K, L, M, NN)
1465. DO 70 I=1, N
1466. Q=H3*WK(I)
1467. IJKO=N+I
1468. IJK1=IB1+I
1469. IJK2=IB2+I
1470. GO TO (25, 30, 35, 40, 45), SW
1471. 25 R=Q
1472. WK(IJK1)=Q
1473. GO TO 50
1474. 30 R=P5*(Q+WK(IJK1))
1475. GO TO 50
1476. 35 R=THREE*Q
1477. WK(IJK2)=R
1478. R=.375DO*(R+WK(IJK1))
1479. GO TO 50
1480. 40 R=WK(IJK1)+FOUR*Q
1481. WK(IJK1)=R
1482. R=OP5*(R-WK(IJK2))
1483. GO TO 50
1484. 45 R=P5*(Q+WK(IJK1))
1485. Q=DABS(R+R - OP5*(Q+WK(IJK2)))
1486. 50 XO(I)=WK(IJKO)+R
1487. IF(SW.NE.5) GO TO 70
1488. C AUTOMATIC STEP CHANGE
1489. E=DABS(XO(I))
1490. R=E5
1491. IF(E.GE.1.D-7) R=E+E5
1492. C TEST ADJUSTMENT OF THE STEP
1493. IF(Q.LT.R .OR. (.NOT. BX)) GO TO 65
1494. BR=.TRUE.
1495. BH=.FALSE.
1496. H=P5*H
1497. IF(DABS(H).GE.HMIN) GO TO 55
1498. C THE STEP IS HALVED RESTORE X AND XO,
1499. C AND GO BACK FOR REPEATED INTEGRATION

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1500. C WITH THIS NEW STEP
1501. H=DSIGN(1.DO,H)*HMIN
1502. BX=.FALSE.
1503. 55 DO 60 J=1,N
1504. IJKN=N+J
1505. X0(J)=WR(IJKN)
1506. 60 CONTINUE
1507. X=X5
1508. GO TO 15
1509. 65 IF(Q.GE.0.03125DO*R) BE=.FALSE.
1510. 70 CONTINUE
1511. GO TO (75,90,80,85,90),SW
1512. 75 X=X+H3
1513. --- GO TO 90 -----
1514. 80 X=X+P5*H3
1515. GO TO 90
1516. 85 X=X+P5*H
1517. 90 CONTINUE
1518. C TEST A POSSIBLE DOUBLING OF THE STEP
1519. IF(.NOT.(BE.AND.BH.AND.BR)) GO TO 95
1520. H=H+H
1521. BX=.TRUE.
1522. 95 BH=.TRUE.
1523. IF(BR) GO TO 5
1524. H=HS
1525. IF(BX .OR. BE) GO TO 9005
1526. IER = 33
1527. GO TO 9000
1528. 100 DO 105 I=1,N
1529. X0(I)=ZERO
1530. 105 CONTINUE
1531. GO TO 9005
1532. 9000 CONTINUE
1533. CALL UERTST(IER,6HDASCRU,NCALL,K,L,M,NN)
1534. 9005 RETURN
1535. END
1536. SUBROUTINE UERTST(IER,NAME,NCALL,K,L,M,NN)
1537. C
1538. DIMENSION ITP(5,4),IBIT(4)
1539. INTEGER*2 NAME(3)
1540. INTEGER WARN,WARF,TERM,PRINTR
1541. EQUIVALENCE (IBIT(1),WARN),(IBIT(2),WARF),(IBIT(3),TERM)
1542. DATA ITP / 32,64,128,0/
1543. *
1544. *
1545. *
1546. *
1547. DATA IBIT / 32,64,128,0/
1548. PRINTR / 6/
1549. IER2=IER
1550. IF (IER2 .GE. WARN).GO TO 5
1551. C NON-DEFINED
1552. IER1=4
1553. GO TO 20
1554. 5 IF (IER2 .LT. TERM) GO TO 10
1555. C TERMINAL
1556. IER1=3
1557. GO TO 20
1558. 10 IF (IER2 .LT. WARF) GO TO 15
1559. C WARNING(WITH FIX)
1560. IER1=2
1561. GO TO 20
1562. C WARNING
1563. 15 IER1=1
1564. C EXTRACT 'N'
1565. 20 IER2=IER2-IBIT(IER1)
1566. C PRINT ERROR MESSAGE
1567. WRITE (PRINTR,25) (ITP(I,IER1),I=1,8),NAME,IER2,IER
1568. 1,NCALL,K,L,M,NN
1569. 25 FORMAT('*** I'M S L(UERTST) ***',504,4X,302,4X,I2,
1570. * (IER,13,4X,NCALL=,I2,412,)
1571. RETURN
1572. END

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*****
CALCULATION OF THE GALERKIN COEFFICIENTS FOR THE FLAP-LAG-TORSIONAL
MOTION OF A ROTOR BLADE IN HOVER USING SHIFTED, AND NORMALIZED,
LEGENDRE POLYNOMIALS (COMPLETE SET).
FOR ACCURACY, ALL OPERATIONS WITH POLYNOMIALS, INCLUDING
INTEGRATION, ARE DONE ALGEBRAICALLY USING THE SSP SUBROUTINES
PMPY, PDER, PINT AND PADM.
(PDER MUST BE SLIGHTLY MODIFIED FOR IT TO BE ABLE TO GIVE
THE DERIVATIVE OF A CONSTANT: THE NULL POLYNOMIAL WITH 1 TERM)
*****

THIS IS THE LATEST VERSION OF THE CALCULATION OF THE GALERKIN
COEFFICIENTS; PREVIOUS VERSIONS, WHICH PROVED TO BE UNSATISFACTORY,
INCLUDED USING DQATR, AND THEN DASCUR, FOR DOING ALL THE
INTEGRATIONS.

*****
      IMPLICIT REAL*8(A-H,O-Z)
      REAL XA
      COMMON PI
      DIMENSION NN(4)
      DIMENSION DELTA(8,8),A(8),B(8),C(8),D(8,8),E(8,8),F(8,8,8),
      1G(8,8,8),H(8,8,8),XI(8,8),XJ(8,8),XK(8,8,8),XM(8,8),XN(8,8),O(8,8)
      2,P(8,8),Q(8),R(8,8),S(8),A3(8,8,8),B3(8,8,8),C3(8,8,8),
      3D3(8,8),E3(8,8,8,8),F3(8,8,8,8),G3(8,8),H3(8,8,8,8),XI3(8,8,8,8)
      4,XJ3(8,8),XK3(8,8),XL3(8,8),XM3(8,8),XN3(8,8,8),O3(8,8,8),
      5P3(8,8,8),Q3(8,8,8),R3(8,8,8,8),S3(8,8,8,8),T3(8,8,8),DEL(8,8)
      DIMENSION U3(8,8,8),V3(8,8,8),W3(8,8,8),X3(8,8,8),Y3(8,8,8),Z3(8,8,8)
      1),A4(8,8,8,8),B4(8,8,8,8),C4(8,8,8,8),D4(8,8,8,8),E4(8,8,8,8),
      2F4(8,8,8,8),G4(8,8,8,8),H4(8),XI4(8,8,8,8),XJ4(8,8,8),XK4(8,8),
      3XL4(8,8,8,8),XM4(8,8,8),XN4(8,8),O4(8,8),P4(8,8,8),Q4(8,8,8,8),
      4R4(8,8,8,8),S4(8,8,8),T4(8,8),U4(8),V4(8,8,8,8),W4(8,8,8)
      66  FORMAT('  6(D14.7,2X)')
      67  FORMAT('  2(D14.7,2X)')
      68  FORMAT('  7/')
      69  FORMAT('  3(D14.7,2X)')
      70  FORMAT('  IER1-TO IER20  ', 2,20(I2,2X))
      71  FORMAT(' ALL THE GALERKIN-LEGENDRE HOVER COEFFICIENTS WERE PUT ON
      1 TAPE NUMBER T07316 (A PRIVATE TAPE) -- (I,J,K,L) UP TO (8,8,8,8)')
      PI=3141592653589793D-15
      DO 2 J=1,8
      R(J,1)=0.DO
      T4(1,J)=0.DO
      D3(1,J)=0.DO
      D3(J,1)=0.DO
      G3(1,J)=0.DO
      G3(J,1)=0.DO
      XJ3(1,J)=0.DO
      XJ3(J,1)=0.DO
      XK4(1,J)=0.DO
      XN4(1,J)=0.DO
      T4(1,J)=0.DO
      DO 3 K=1,8
      XK(J,1,K)=0.DO
      XK(J,2,K)=0.DO
      XK(J,K,1)=0.DO
      A3(1,J,K)=0.DO
      A3(J,K,1)=0.DO
      O3(1,J,K)=0.DO
      O3(J,1,K)=0.DO
      O3(J,K,1)=0.DO
      Q3(1,J,K)=0.DO
      Q3(J,1,K)=0.DO
      Q3(J,K,1)=0.DO
      U3(1,J,K)=0.DO
      XJ4(1,J,K)=0.DO
      XM4(1,J,K)=0.DO
      P4(1,J,K)=0.DO
      P4(J,K,1)=0.DO
      P4(J,K,2)=0.DO
      W4(1,J,K)=0.DO
      W4(J,K,1)=0.DO
      DO 4 L=1,8
      B3(1,J,K,L)=0.DO
      B3(J,K,L,1)=0.DO
      B3(J,K,L,2)=0.DO

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C3(J,I,K,L)=0.DO  
C3(J,I,K,L)=0.DO  
C3(J,I,K,L)=0.DO  
C3(J,I,K,L)=0.DO  
F3(1,I,K,L)=0.DO  
F3(J,I,K,L)=0.DO  
F3(J,I,K,L)=0.DO  
F3(J,I,K,L)=0.DO  
F3(J,I,K,L)=0.DO  
F3(J,I,K,L)=0.DO  
F3(J,I,K,L)=0.DO  
F3(J,I,K,L)=0.DO  
F3(J,I,K,L)=0.DO  
H3(1,I,K,L)=0.DO  
H3(J,I,K,L)=0.DO  
H3(J,I,K,L)=0.DO  
X13(1,J,K,L)=0.DO  
X13(J,I,K,L)=0.DO  
X13(J,I,K,L)=0.DO  
R3(1,J,K,L)=0.DO  
R3(J,I,K,L)=0.DO  
R3(J,I,K,L)=0.DO  
S3(1,I,K,L)=0.DO  
S3(J,I,K,L)=0.DO  
S3(J,I,K,L)=0.DO  
A4(1,I,K,L)=0.DO  
A4(J,I,K,L)=0.DO  
B4(1,I,K,L)=0.DO  
C4(1,I,K,L)=0.DO  
C4(J,I,K,L)=0.DO  
C4(J,I,K,L)=0.DO  
D4(1,I,K,L)=0.DO  
E4(1,I,K,L)=0.DO  
F4(1,I,K,L)=0.DO  
F4(J,I,K,L)=0.DO  
G4(1,I,K,L)=0.DO  
G4(J,I,K,L)=0.DO  
G4(J,I,K,L)=0.DO  
XI4(1,I,K,L)=0.DO  
XI4(J,I,K,L)=0.DO  
XI4(J,I,K,L)=0.DO  
XL4(1,I,K,L)=0.DO  
XL4(J,I,K,L)=0.DO  
XL4(J,I,K,L)=0.DO  
Q4(1,I,K,L)=0.DO  
Q4(J,I,K,L)=0.DO  
Q4(J,I,K,L)=0.DO  
Q4(J,I,K,L)=0.DO  
Q4(J,I,K,L)=0.DO  
R4(1,I,K,L)=0.DO  
R4(J,I,K,L)=0.DO  
R4(J,I,K,L)=0.DO  
R4(J,I,K,L)=0.DO  
R4(J,I,K,L)=0.DO  
V4(1,I,K,L)=0.DO  
V4(J,I,K,L)=0.DO  
V4(J,I,K,L)=0.DO  
V4(J,I,K,L)=0.DO  
4 CONTINUE  
N6 CONTINUE  
N2 CONTINUE  
C *** CALCULATION OF THE IJKL-SYMMETRIC I3 COEFFICIENTS  
IR1=0  
IR2=0  
DO 110 I=2,8  
DO 111 J=2,8  
IF(J.GE.I) GO TO 112  
IR1=1  
112 DO 113 K=2,8  
IF(K.GE.J) GO TO 114  
IR2=1  
114 DO 115 L=2,8  
IF(L.LT.K) GO TO 141  
IF(IR1.EQ.O.AND.IR2.EQ.O) GO TO 119  
GO TO 141  
119 CALL F13(XI3(I,J,K,L),I,J,K,L)  
GO TO 115  
C ---- PUT IJKL IN INCREASING ORDER
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164. 141 NN(1)=I
165. NN(2)=J
166. NN(3)=K
167. NN(4)=L
168. IG=I
169. DO 130 M=2,4
170. IF(NN(M).GE.IG) GO TO 131
171. KK=M-1
172. DO 132 N=1, KK
173. IF(NN(M).GE.NN(N)) GO TO 132
174. ITX=NN(N)
175. NN(N)=NN(M)
176. NN(M)=ITX
177. 132 CONTINUE
178. 131 IG=NN(M)
179. 130 CONTINUE
180. M1=NN(1)
181. M2=NN(2)
182. M3=NN(3)
183. M4=NN(4)
184. XI3(I,J,K,L)=XI3(M1,M2,M3,M4)
185. 115 CONTINUE
186. IR2=0
187. 113 CONTINUE
188. 111 IR1=0
189. 110 CONTINUE
190. C ***** CALCULATION OF THE --(I,J,K,L) COEFFICIENTS WITH IJ-SYMMETRY,
191. C ** OF THE M AND N COEFFICIENTS,
192. --- C --- AND ALSO OF THE G3, J3, Q3, AND Q4 COEFFICIENTS BY DIRECT INTEGRATION
193. DO 5 I=1,8
194. DO 6 J=1,8
195. CALL FM(XM(I,J),I,J,K,L)
196. CALL FN(XN(I,J),I,J,K,L)
197. IF(I.EQ.1) GO TO 666
198. CALL FG3(G3(I,J),I,J,K,L)
199. CALL FJ3(XJ3(I,J),I,J,K,L)
200. DO 7 K=2,8
201. CALL FQ3(Q3(I,J,K),I,J,K,L)
202. DO 8 L=1,8
203. CALL FR3(R3(I,J,K,L),I,J,K,L)
204. CALL FS3(S3(I,J,K,L),I,J,K,L)
205. R3(J,I,K,L)=R3(I,J,K,L)
206. S3(J,I,K,L)=S3(I,J,K,L)
207. IF(L.LE.2) GO TO 8
208. CALL FQ4(Q4(I,J,K,L),I,J,K,L)
209. Q4(J,I,K,L)=Q4(I,J,K,L)
210. 8 CONTINUE
211. G3(J,I,K)=G3(I,J,K)
212. 7 CONTINUE
213. XJ3(J,I)=XJ3(I,J)
214. G3(J,I)=G3(I,J)
215. 666 XM(J,I)=XM(I,J)
216. XN(J,I)=XN(I,J)
217. 6 CONTINUE
218. 5 CONTINUE
219. C **** CALCULATION OF THE --(I,J,K,L) COEFFICIENTS WITH JK-SYMMETRY,
220. C ** AND ALSO OF THE Q3 AND U3 COEFFICIENTS BY DIRECT INTEGRATION **
221. DO 9 I=2,8
222. DO 10 J=1,8
223. DO 11 K=J,8
224. IF(J.NE.1) CALL FQ3(Q3(I,J,K),I,J,K,L)
225. CALL U3D4(U3(I,J,K),I,J,K,L,1,0)
226. DO 12 L=1,8
227. CALL ACEI4(E4(I,J,K,L),I,J,K,L,0,0,1,0)
228. IF(L.GT.2) CALL FB3(B3(I,J,K,L),I,J,K,L)
229. IF(J.EQ.1) GO TO 1203
230. 1201 CALL ACEI4(XI4(I,J,K,L),I,J,K,L,0,0,0,1)
231. CALL ACEI4(C4(I,J,K,L),I,J,K,L,0,1,0,0)
232. IF(L.NE.1) CALL FV4(V4(I,J,K,L),I,J,K,L)
233. 1203 B3(I,K,J,L)=B3(I,J,K,L)
234. C4(I,K,J,L)=C4(I,J,K,L)
235. E4(I,K,J,L)=E4(I,J,K,L)
236. XI4(I,K,J,L)=XI4(I,J,K,L)
237. V4(I,K,J,L)=V4(I,J,K,L)
238. 12 CONTINUE
239. Q3(I,K,J)=Q3(I,J,K)
240. U3(I,K,J)=U3(I,J,K)
241. 11 CONTINUE
242. 10 CONTINUE
243. 9 CONTINUE
244. C ***** CALCULATION OF THE --(I,J,K,L) COEFFICIENTS WITH KL-SYMMETRY,
245. C ** AND ALSO OF THE G3 AND F3 COEFFICIENTS BY DIRECT INTEGRATION **
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246. DO 13 I=2,8
247. DO 14 J=1,8
248. DO 15 K=1,8
249. DO 16 L=K,8
250. CALL USD4(D4(I,J,K,L),I,J,K,L,0,1)
251. IF(J.NE.1) CALL FF4(F4(I,J,K,L),I,J,K,L)
252. IF(K.EQ.1) GO TO 1601
253. CALL FG4(G4(I,J,K,L),I,J,K,L)
254. CALL FL4(XL4(I,J,K,L),I,J,K,L)
255. IF(J.LT.2) GO TO 1601
256. CALL FF3(F3(I,J,K,L),I,J,K,L)
257. IF(J.NE.3) CALL FC3(C3(I,J,K,L),I,J,K,L)
258. 1601 F4(I,J,L,K)=F4(I,J,K,L)
259. G4(I,J,L,K)=G4(I,J,K,L)
260. XL4(I,J,L,K)=XL4(I,J,K,L)
261. D4(I,J,L,K)=D4(I,J,K,L)
262. F3(I,J,L,K)=F3(I,J,K,L)
263. C3(I,J,L,K)=C3(I,J,K,L)
264. 16 CONTINUE
265. 15 CONTINUE
266. 14 CONTINUE
267. 13 CONTINUE
268. C *** CALCULATION OF THE JKL-SYMMETRIC B4 COEFFICIENT,
269. C ** AND ALSO OF THE D3,K4,N4,T4,A3,J4,M4,W4 COEFFICIENTS
270. C ** BY DIRECT INTEGRATION **
271. IR=0
272. DO 210 I=2,8
273. DO 211 J=1,8
274. CALL J4K4(XK4(I,J),I,J,K,L,0,1)
275. CALL FN4(XN4(I,J),I,J,K,L)
276. CALL FT4(T4(I,J),I,J,K,L)
277. IF(J.NE.1) CALL FD3(D3(I,J),I,J,K,L)
278. DO 212 K=1,8
279. CALL J4K4(XJ4(I,J,K),I,J,K,L,1,0)
280. CALL FM4(XM4(I,J,K),I,J,K,L)
281. IF(K.EQ.1) GO TO 2111
282. CALL A3P4(A3(I,J,K),I,J,K,L,1,0)
283. CALL FW4(W4(I,J,K),I,J,K,L)
284. 2111 IF(K.GE.J) GO TO 213
285. IR=1
286. 213 DO 214 L=1,8
287. IF(L.LT.K) GO TO 241
288. IF(IR.EQ.0) GO TO 215
289. GO TO 241
290. 215 CALL FB4(B4(I,J,K,L),I,J,K,L)
291. GO TO 214
292. C --- PUT JKL IN INCREASING ORDER
293. 241 NN(1)=J
294. NN(2)=K
295. NN(3)=L
296. IG=J
297. DO 216 M=2,8
298. IF(NN(M).GE.IG) GO TO 217
299. KK=M-1
300. DO 218 N=1,KK
301. IF(NN(M).GE.NN(N)) GO TO 218
302. ITX=NN(N)
303. NN(N)=NN(M)
304. NN(M)=ITX
305. 218 CONTINUE
306. 217 IG=NN(M)
307. 216 CONTINUE
308. M1=NN(1)
309. M2=NN(2)
310. M3=NN(3)
311. B4(I,J,K,L)=B4(I,M1,M2,M3)
312. 214 CONTINUE
313. IR=0
314. 212 CONTINUE
315. 211 CONTINUE
316. 210 CONTINUE
317. C ** CALCULATION OF THE (IJ,KL)-SYMMETRIC H3 AND R4 COEFFICIENTS,
318. C ***** AND ALSO OF E3 BY DIRECT INTEGRATION *****
319. DO 20 I=2,8
320. DO 21 J=1,8
321. DO 22 K=2,8
322. DO 23 L=K,8
323. CALL FE3(E3(I,J,K,L),I,J,K,L)
324. IF(K.EQ.2) GO TO 231
325. CALL FR4(R4(I,J,K,L),I,J,K,L)
326. 231 CALL FH3(H3(I,J,K,L),I,J,K,L)

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327. H3(I,J,L,K)=H3(I,J,K,L)
328. H3(J,I,K,L)=H3(I,J,K,L)
329. H3(I,J,L,K)=H3(I,J,K,L)
330. R4(I,J,L,K)=R4(I,J,K,L)
331. R4(J,I,K,L)=R4(I,J,K,L)
332. R4(I,J,L,K)=R4(I,J,K,L)
333. E3(I,J,L,K)=E3(I,J,K,L)
334. E3(J,I,K,L)=E3(I,J,K,L)
335. E3(I,J,L,K)=E3(I,J,K,L)
336. GO TO 23
337. 23 CONTINUE
338. 22 CONTINUE
339. 21 CONTINUE
340. 20 CONTINUE
341. C *** CALCULATION OF THE A4 AND P4 COEFFICIENTS
342. DO 25 I=2,8
343. DO 26 J=1,8
344. DO 27 K=2,8
345. IF(K.GE.3) CALL A3P4(P4(I,J,K),I,J,K,L,0,1)
346. DO 28 L=1,8
347. CALL ACEI4(A4(I,J,K,L),I,J,K,L,1,0,0,0)
348. 28 CONTINUE
349. 27 CONTINUE
350. 26 CONTINUE
351. 25 CONTINUE
352. C *** CALCULATION OF THE REMAINING COEFFICIENTS
353. C ** THE MAIN GENERATORS ARE F4,G4,V4,XI3,A4,C4,I4,E4,L4,S3,D4,Q4,R4
354. C *** (P4 IS ALSO A GENERATOR, BUT WAS NOT USED AS SUCH) ***
355. ROOT3=2*DSQRT(3.DO)
356. ROOT5=DSQRT(5.DO)
357. ROOT7=DSQRT(7.DO)
358. XXL3=-ROOT3*PI**2
359. DO 29 I=1,8
360. A(I)=F4(I,2,1,1)/ROOT3
361. B(I)=G4(I,1,2,2)/12
362. C(I)=V4(I,2,2,2)/(12*ROOT3)
363. DO 30 J=1,8
364. IF(J.NE.1) CALL FR(R(I,J),I,J,K,L)
365. DEL(I,J)=0.DO
366. IF(J.EQ.1) DEL(I,J)=1.DO
367. DELTA(I,J)=Q4(I,2,2,J)/12
368. F(I,J)=-DEL(I,J)*((PI*(I-0.5DO))**2)
369. D(I,J)=-XI3(I,J,2,2)/24
370. E(I,J)=G4(I,J,2,2)/12
371. XI(I,J)=A4(I,1,2,J)/ROOT3
372. XJ(I,J)=C4(I,2,2,J)/12
373. Q(I,J)=G4(I,1,J,2)/ROOT3
374. XL3(I,J)=A3(I,J,2)/(XXL3*(J-0.5DO)**2)
375. XK3(I,J)=R4(I,J,3,3)/720.DO
376. D3(I,J)=D3(I,J)+XK3(I,J)
377. IF(DABS(D3(I,J)).LT.1.E-7) D3(I,J)=0.DO
378. W3(I,J)=F4(I,J,1,1)
379. Q4(I,J)=E4(I,1,1,J)
380. DO 31 K=1,8
381. IF(K.NE.1.AND.J.GT.2) CALL FK(XK(I,J,K),I,J,K,L)
382. F(I,J,K)=XL4(K,1,I,J)
383. G(I,J,K)=A4(I,J,2,K)/ROOT3
384. H(I,J,K)=E4(I,J,1,K)
385. XN3(I,J,K)=G4(I,1,J,K)
386. P3(I,J,K)=S3(I,J,K,1)
387. T3(I,J,K)=G4(I,J,K,2)/ROOT3
388. V3(I,J,K)=F4(I,2,J,K)/ROOT3
389. X3(I,J,K)=D4(I,1,J,K)
390. Y3(I,J,K)=A4(I,1,J,K)
391. Z3(I,J,K)=F4(I,K,J,1)
392. S4(I,J,K)=V4(I,J,K,2)/ROOT3
393. 31 CONTINUE
394. XM3(I,J)=XM4(I,J,1)
395. 30 CONTINUE
396. H4(I)=XN4(I,1)
397. CALL FU4(U4(I),I,J,K,L)
398. 29 CONTINUE
399. SA=DSQRT(2.DO)/PI**2
400. DO 36 I=1,8
401. Q(I)=-XL3(2,I)/ROOT3
402. SSA=I-0.5DO
403. S(I)=SA*DSIN(SSA*PI)/SSA**2
404. 36 CONTINUE
405. DO 400 I=1,8
406. WRITE(50) A(I),B(I),C(I),Q(I),S(I),H4(I),U4(I)
407. 400 CONTINUE
408. DO 411 I=1,8

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409.      DO 420 J=1,8
410.      WRITE(50) DEL(I,J),DELTA(I,J),D(I,J),E(I,J),XI(I,J),XJ(I,J)
411.      WRITE(50) XM(I,J),XN(I,J),O(I,J),F(I,J),R(I,J),D3(I,J)
412.      WRITE(50) G3(I,J),XJ3(I,J),XK3(I,J),XL3(I,J),XM3(I,J),W3(I,J)
413.      WRITE(50) XK4(I,J),XN4(I,J),O4(I,J),T4(I,J)
414.      420 CONTINUE
415.      411 CONTINUE
416.      DO 430 I=1,8
417.      DO 440 J=1,8
418.      DO 450 K=1,8
419.      ----- WRITE(50) F(I,J,K),G(I,J,K),H(I,J,K),XK(I,J,K),A3(I,J,K)
420.      1,XN3(I,J,K)
421.      WRITE(50) O3(I,J,K),P3(I,J,K),Q3(I,J,K),T3(I,J,K),U3(I,J,K)
422.      1,V3(I,J,K)
423.      WRITE(50) X3(I,J,K),Y3(I,J,K),Z3(I,J,K),XJ4(I,J,K),XM4(I,J,K)
424.      1,P4(I,J,K)
425.      WRITE(50) S4(I,J,K),W4(I,J,K)
426.      450 CONTINUE
427.      440 CONTINUE
428.      430 CONTINUE
429.      DO 460 I=1,8
430.      DO 470 J=1,8
431.      DO 480 K=1,8
432.      DO 490 L=1,8
433.      WRITE(50) B3(I,J,K,L),C3(I,J,K,L),E3(I,J,K,L),F3(I,J,K,L)
434.      1,H3(I,J,K,L),XI3(I,J,K,L)
435.      WRITE(50) R3(I,J,K,L),S3(I,J,K,L),A4(I,J,K,L),B4(I,J,K,L)
436.      1,C4(I,J,K,L),D4(I,J,K,L)
437.      WRITE(50) E4(I,J,K,L),F4(I,J,K,L),G4(I,J,K,L),XI4(I,J,K,L)
438.      1,XL4(I,J,K,L),Q4(I,J,K,L)
439.      WRITE(50) R4(I,J,K,L),V4(I,J,K,L)
440.      490 CONTINUE
441.      480 CONTINUE
442.      470 CONTINUE
443.      460 CONTINUE
444.      WRITE(6,71)
445.      C *****
446.      C *****
447.      GO TO 499
448.      C *****
449.      C *****
450.      65 FORMAT('1')
451.      66 FORMAT(' ',7(D14.7,2X))
452.      67 FORMAT(' ',5(D14.7,2X))
453.      68 FORMAT(' ')
454.      69 FORMAT(' ',/)
455.      WRITE(6,65)
456.      DO 40 I=1,5
457.      WRITE(6,66) A(I),B(I),C(I),Q(I),S(I),H4(I),U4(I)
458.      40 CONTINUE
459.      WRITE(6,69)
460.      DO 41 I=1,5
461.      WRITE(6,67) DEL(I,1),DEL(I,2),DEL(I,3),DEL(I,4),DEL(I,5)
462.      41 CONTINUE
463.      WRITE(6,68)
464.      WRITE(6,800)
465.      800 FORMAT(' DELTA')
466.      DO 42 I=1,5
467.      ----- WRITE(6,67) DELTA(I,1),DELTA(I,2),DELTA(I,3),DELTA(I,4),DELTA(I,5)
468.      42 CONTINUE
469.      WRITE(6,68)
470.      WRITE(6,801)
471.      801 FORMAT(' D')
472.      DO 43 I=1,5
473.      WRITE(6,67) D(I,1),D(I,2),D(I,3),D(I,4),D(I,5)
474.      43 CONTINUE
475.      WRITE(6,68)
476.      WRITE(6,802)
477.      802 FORMAT(' E')
478.      DO 44 I=1,5
479.      WRITE(6,67) E(I,1),E(I,2),E(I,3),E(I,4),E(I,5)
480.      44 CONTINUE
481.      WRITE(6,68)
482.      WRITE(6,803)
483.      803 FORMAT(' I')
484.      DO 45 I=1,5
485.      WRITE(6,67) XI(I,1),XI(I,2),XI(I,3),XI(I,4),XI(I,5)
486.      45 CONTINUE
487.      WRITE(6,68)
488.      WRITE(6,804)
489.      804 FORMAT(' J')
490.      DO 46 I=1,5

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491. WRITE(6,67) XJ(I,1),XJ(I,2),XJ(I,3),XJ(I,4),XJ(I,5)
492. 46 CONTINUE
493. WRITE(6,68)
494. WRITE(6,805)
495. 805 FORMAT(' M')
496. DO 47 I=1,5
497. WRITE(6,67) XM(I,1),XM(I,2),XM(I,3),XM(I,4),XM(I,5)
498. 47 CONTINUE
499. WRITE(6,68)
500. WRITE(6,806)
501. 806 FORMAT(' N')
502. DO 48 I=1,5
503. WRITE(6,67) XN(I,1),XN(I,2),XN(I,3),XN(I,4),XN(I,5)
504. 48 CONTINUE
505. WRITE(6,68)
506. WRITE(6,807)
507. 807 FORMAT(' O')
508. DO 49 I=1,5
509. WRITE(6,67) O(I,1),O(I,2),O(I,3),O(I,4),O(I,5)
510. 49 CONTINUE
511. WRITE(6,65)
512. WRITE(6,808)
513. 808 FORMAT(' P')
514. DO 50 I=1,5
515. WRITE(6,67) P(I,1),P(I,2),P(I,3),P(I,4),P(I,5)
516. 50 CONTINUE
517. WRITE(6,68)
518. WRITE(6,809)
519. 809 FORMAT(' R')
520. DO 51 I=1,5
521. WRITE(6,67) R(I,1),R(I,2),R(I,3),R(I,4),R(I,5)
522. 51 CONTINUE
523. WRITE(6,68)
524. WRITE(6,810)
525. 810 FORMAT(' D3')
526. DO 52 I=1,5
527. WRITE(6,67) D3(I,1),D3(I,2),D3(I,3),D3(I,4),D3(I,5)
528. 52 CONTINUE
529. WRITE(6,68)
530. WRITE(6,811)
531. 811 FORMAT(' G3')
532. DO 53 I=1,5
533. WRITE(6,67) G3(I,1),G3(I,2),G3(I,3),G3(I,4),G3(I,5)
534. 53 CONTINUE
535. WRITE(6,68)
536. WRITE(6,812)
537. 812 FORMAT(' J3')
538. DO 54 I=1,5
539. WRITE(6,67) XJ3(I,1),XJ3(I,2),XJ3(I,3),XJ3(I,4),XJ3(I,5)
540. 54 CONTINUE
541. WRITE(6,68)
542. WRITE(6,813)
543. 813 FORMAT(' K3')
544. DO 55 I=1,5
545. WRITE(6,67) XK3(I,1),XK3(I,2),XK3(I,3),XK3(I,4),XK3(I,5)
546. 55 CONTINUE
547. WRITE(6,68)
548. WRITE(6,814)
549. 814 FORMAT(' L3')
550. DO 56 I=1,5
551. WRITE(6,67) XL3(I,1),XL3(I,2),XL3(I,3),XL3(I,4),XL3(I,5)
552. 56 CONTINUE
553. WRITE(6,68)
554. WRITE(6,815)
555. 815 FORMAT(' M3')
556. DO 57 I=1,5
557. WRITE(6,67) XM3(I,1),XM3(I,2),XM3(I,3),XM3(I,4),XM3(I,5)
558. 57 CONTINUE
559. WRITE(6,68)
560. WRITE(6,816)
561. 816 FORMAT(' W3')
562. DO 58 I=1,5
563. WRITE(6,67) W3(I,1),W3(I,2),W3(I,3),W3(I,4),W3(I,5)
564. 58 CONTINUE
565. WRITE(6,65)
566. WRITE(6,817)
567. 817 FORMAT(' K4')
568. DO 59 I=1,5
569. WRITE(6,67) XK4(I,1),XK4(I,2),XK4(I,3),XK4(I,4),XK4(I,5)
570. 59 CONTINUE
571. WRITE(6,68)
572. WRITE(6,818)

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OF POOR QUALITY

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573.      818 FORMAT(' N4')
574.      DO 60 I=1,5
575.      WRITE(6,67) XN4(I,1),XN4(I,2),XN4(I,3),XN4(I,4),XN4(I,5)
576.      60 CONTINUE
577.      WRITE(6,68)
578.      WRITE(6,819)
579.      819 FORMAT(' O4')
580.      DO 61 I=1,5
581.      WRITE(6,67) O4(I,1),O4(I,2),O4(I,3),O4(I,4),O4(I,5)
582.      61 CONTINUE
583.      WRITE(6,68)
584.      WRITE(6,820)
585.      820 FORMAT(' T4')
586.      DO 62 I=1,5
587.      WRITE(6,67) T4(I,1),T4(I,2),T4(I,3),T4(I,4),T4(I,5)
588.      62 CONTINUE
589.      WRITE(6,65)
590.      WRITE(6,821)
591.      821 FORMAT(' F')
592.      DO 501 I=1,5
593.      DO 502 J=1,5
594.      WRITE(6,67) F(I,J,1),F(I,J,2),F(I,J,3),F(I,J,4),F(I,J,5)
595.      502 CONTINUE
596.      WRITE(6,68)
597.      501 CONTINUE
598.      WRITE(6,822)
599.      822 FORMAT(' G')
600.      DO 503 I=1,5
601.      DO 504 J=1,5
602.      WRITE(6,67) G(I,J,1),G(I,J,2),G(I,J,3),G(I,J,4),G(I,J,5)
603.      504 CONTINUE
604.      WRITE(6,68)
605.      503 CONTINUE
606.      WRITE(6,65)
607.      WRITE(6,823)
608.      823 FORMAT(' H')
609.      DO 505 I=1,5
610.      DO 506 J=1,5
611.      WRITE(6,67) H(I,J,1),H(I,J,2),H(I,J,3),H(I,J,4),H(I,J,5)
612.      506 CONTINUE
613.      WRITE(6,68)
614.      505 CONTINUE
615.      WRITE(6,824)
616.      824 FORMAT(' K')
617.      DO 507 I=1,5
618.      DO 508 J=1,5
619.      WRITE(6,67) XK(I,J,1),XK(I,J,2),XK(I,J,3),XK(I,J,4),XK(I,J,5)
620.      508 CONTINUE
621.      WRITE(6,68)
622.      507 CONTINUE
623.      WRITE(6,65)
624.      WRITE(6,825)
625.      825 FORMAT(' A3')
626.      DO 509 I=1,5
627.      DO 510 J=1,5
628.      WRITE(6,67) A3(I,J,1),A3(I,J,2),A3(I,J,3),A3(I,J,4),A3(I,J,5)
629.      510 CONTINUE
630.      WRITE(6,68)
631.      509 CONTINUE
632.      WRITE(6,826)
633.      826 FORMAT(' N3')
634.      DO 511 I=1,5
635.      DO 512 J=1,5
636.      WRITE(6,67) XN3(I,J,1),XN3(I,J,2),XN3(I,J,3),XN3(I,J,4),XN3(I,J,4)
637.      512 CONTINUE
638.      WRITE(6,68)
639.      511 CONTINUE
640.      WRITE(6,65)
641.      WRITE(6,827)
642.      827 FORMAT(' O3')
643.      DO 513 I=1,5
644.      DO 514 J=1,5
645.      WRITE(6,67) O3(I,J,1),O3(I,J,2),O3(I,J,3),O3(I,J,4),O3(I,J,5)
646.      514 CONTINUE
647.      WRITE(6,68)
648.      513 CONTINUE
649.      WRITE(6,828)
650.      828 FORMAT(' P3')
651.      DO 515 I=1,5
652.      DO 516 J=1,5
653.      WRITE(6,67) P3(I,J,1),P3(I,J,2),P3(I,J,3),P3(I,J,4),P3(I,J,5)

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ORIGINAL PAGE 10
OF POOR QUALITY

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654. 516 CONTINUE
655. WRITE(6,68)
656. 515 CONTINUE
657. WRITE(6,65)
658. WRITE(6,829)
659. 829 FORMAT(' Q3')
660. DO 517 I=1,5
661. DO 518 J=1,5
662. WRITE(6,67) Q3(I,J,1),Q3(I,J,2),Q3(I,J,3),Q3(I,J,4),Q3(I,J,5)
663. 518 CONTINUE
664. WRITE(6,68)
665. 517 CONTINUE
666. WRITE(6,830)
667. 830 FORMAT(' T3')
668. DO 519 I=1,5
669. DO 520 J=1,5
670. WRITE(6,67) T3(I,J,1),T3(I,J,2),T3(I,J,3),T3(I,J,4),T3(I,J,5)
671. 520 CONTINUE
672. WRITE(6,68)
673. 519 CONTINUE
674. WRITE(6,65)
675. WRITE(6,8310)
676. 8310 FORMAT(' U3')
677. DO 521 I=1,5
678. DO 522 J=1,5
679. WRITE(6,67) U3(I,J,1),U3(I,J,2),U3(I,J,3),U3(I,J,4),U3(I,J,5)
680. 522 CONTINUE
681. WRITE(6,68)
682. 521 CONTINUE
683. WRITE(6,831)
684. 831 FORMAT(' V3')
685. DO 523 I=1,5
686. DO 524 J=1,5
687. WRITE(6,67) V3(I,J,1),V3(I,J,2),V3(I,J,3),V3(I,J,4),V3(I,J,5)
688. 524 CONTINUE
689. WRITE(6,68)
690. 523 CONTINUE
691. WRITE(6,65)
692. WRITE(6,832)
693. 832 FORMAT(' X3')
694. DO 525 I=1,5
695. DO 526 J=1,5
696. WRITE(6,67) X3(I,J,1),X3(I,J,2),X3(I,J,3),X3(I,J,4),X3(I,J,5)
697. 526 CONTINUE
698. WRITE(6,68)
699. 525 CONTINUE
700. WRITE(6,833)
701. 833 FORMAT(' Y3')
702. DO 527 I=1,5
703. DO 528 J=1,5
704. WRITE(6,67) Y3(I,J,1),Y3(I,J,2),Y3(I,J,3),Y3(I,J,4),Y3(I,J,5)
705. 528 CONTINUE
706. WRITE(6,68)
707. 527 CONTINUE
708. WRITE(6,65)
709. WRITE(6,834)
710. 834 FORMAT(' Z3')
711. DO 529 I=1,5
712. DO 530 J=1,5
713. WRITE(6,67) Z3(I,J,1),Z3(I,J,2),Z3(I,J,3),Z3(I,J,4),Z3(I,J,5)
714. 530 CONTINUE
715. WRITE(6,68)
716. 529 CONTINUE
717. WRITE(6,835)
718. 835 FORMAT(' J4')
719. DO 531 I=1,5
720. DO 532 J=1,5
721. WRITE(6,67) XJ4(I,J,1),XJ4(I,J,2),XJ4(I,J,3),XJ4(I,J,4),XJ4(I,J,5)
722. 532 CONTINUE
723. WRITE(6,68)
724. 531 CONTINUE
725. WRITE(6,65)
726. WRITE(6,836)
727. 836 FORMAT(' M4')
728. DO 533 I=1,5
729. DO 534 J=1,5
730. WRITE(6,67) XM4(I,J,1),XM4(I,J,2),XM4(I,J,3),XM4(I,J,4),XM4(I,J,5)
731. 534 CONTINUE
732. WRITE(6,68)
733. 533 CONTINUE
734. WRITE(6,837)
735. 837 FORMAT(' P4')

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736.      DO 535 I=1,5
737.      DO 536 J=1,5
738.      WRITE(6,67) P4(I,J,1),P4(I,J,2),P4(I,J,3),P4(I,J,4),P4(I,J,5)
739. 536 CONTINUE
740.      WRITE(6,68)
741. 535 CONTINUE
742.      WRITE(6,65)
743.      WRITE(6,838)
744. 838 FORMAT(' S4')
745.      DO 537 I=1,5
746.      DO 538 J=1,5
747.      WRITE(6,67) S4(I,J,1),S4(I,J,2),S4(I,J,3),S4(I,J,4),S4(I,J,5)
748. 538 CONTINUE
749.      WRITE(6,68)
750. 537 CONTINUE
751.      WRITE(6,839)
752. 839 FORMAT(' W4')
753.      DO 539 I=1,5
754.      DO 540 J=1,5
755.      WRITE(6,67) W4(I,J,1),W4(I,J,2),W4(I,J,3),W4(I,J,4),W4(I,J,5)
756. 540 CONTINUE
757.      WRITE(6,68)
758. 539 CONTINUE
759.      WRITE(6,65)
760.      WRITE(6,840)
761. 840 FORMAT(' B3')
762.      DO 541 I=1,5
763.      DO 542 J=1,5
764.      DO 543 K=1,5
765.      WRITE(6,67) B3(I,J,K,1),B3(I,J,K,2),B3(I,J,K,3),B3(I,J,K,4)
766.      1,B3(I,J,K,5)
767. 543 CONTINUE
768.      WRITE(6,68)
769. 542 CONTINUE
770.      IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
771.      IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
772. 541 CONTINUE
773.      WRITE(6,65)
774.      WRITE(6,841)
775. 841 FORMAT(' C3')
776.      DO 544 I=1,5
777.      DO 545 J=1,5
778.      DO 546 K=1,5
779.      WRITE(6,67) C3(I,J,K,1),C3(I,J,K,2),C3(I,J,K,3),C3(I,J,K,4)
780.      1,C3(I,J,K,5)
781. 546 CONTINUE
782.      WRITE(6,68)
783. 545 CONTINUE
784.      IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
785.      IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
786. 544 CONTINUE
787.      WRITE(6,65)
788.      WRITE(6,842)
789. 842 FORMAT(' E3')
790.      DO 547 I=1,5
791.      DO 548 J=1,5
792.      DO 549 K=1,5
793.      WRITE(6,67) E3(I,J,K,1),E3(I,J,K,2),E3(I,J,K,3),E3(I,J,K,4)
794.      1,E3(I,J,K,5)
795. 549 CONTINUE
796.      IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
797.      IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
798. 548 CONTINUE
799. 547 CONTINUE
800.      WRITE(6,65)
801.      WRITE(6,843)
802. 843 FORMAT(' F3')
803.      DO 550 I=1,5
804.      DO 551 J=1,5
805.      DO 552 K=1,5
806.      WRITE(6,67) F3(I,J,K,1),F3(I,J,K,2),F3(I,J,K,3),F3(I,J,K,4)
807.      1,F3(I,J,K,5)
808. 552 CONTINUE
809.      WRITE(6,68)
810. 551 CONTINUE
811.      IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
812.      IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
813. 550 CONTINUE
814.      WRITE(6,65)
815.      WRITE(6,844)
816. 844 FORMAT(' H3')
817.      DO 553 I=1,5

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001. DO 554 J=1,5
002. DO 555 K=1,5
003. WRITE(6,67) H3(I,J,1),H3(I,J,K,2),H3(I,J,K,3),H3(I,J,K,4)
004. 1,H3(I,J,K,5)
005. 555 CONTINUE
006. WRITE(6,68)
007. 554 CONTINUE
008. IF(1.EQ.2.OR.1.EQ.4) WRITE(6,65)
009. IF(1.EQ.1.OR.1.EQ.3) WRITE(6,69)
010. 553 CONTINUE
011. WRITE(6,65)
012. WRITE(6,845)
013. 845 FORMAT(' I3')
014. DO 556 I=1,5
015. DO 557 J=1,5
016. DO 558 K=1,5
017. WRITE(6,67) XI3(I,J,K,1),XI3(I,J,K,2),XI3(I,J,K,3)
018. 1,XI3(I,J,K,4),XI3(I,J,K,5)
019. 558 CONTINUE
020. WRITE(6,68)
021. 557 CONTINUE
022. IF(1.EQ.2.OR.1.EQ.4) WRITE(6,65)
023. IF(1.EQ.1.OR.1.EQ.3) WRITE(6,69)
024. 556 CONTINUE
025. WRITE(6,65)
026. WRITE(6,846)
027. 846 FORMAT(' R3')
028. DO 559 I=1,5
029. DO 560 J=1,5
030. DO 561 K=1,5
031. WRITE(6,67) R3(I,J,K,1),R3(I,J,K,2),R3(I,J,K,3),R3(I,J,K,4)
032. 1,R3(I,J,K,5)
033. 561 CONTINUE
034. WRITE(6,68)
035. 560 CONTINUE
036. IF(1.EQ.2.OR.1.EQ.4) WRITE(6,65)
037. IF(1.EQ.1.OR.1.EQ.3) WRITE(6,69)
038. 559 CONTINUE
039. WRITE(6,65)
040. WRITE(6,847)
041. 847 FORMAT(' S3')
042. DO 562 I=1,5
043. DO 563 J=1,5
044. DO 564 K=1,5
045. WRITE(6,67) S3(I,J,K,1),S3(I,J,K,2),S3(I,J,K,3),S3(I,J,K,4)
046. 1,S3(I,J,K,5)
047. 564 CONTINUE
048. WRITE(6,68)
049. 563 CONTINUE
050. IF(1.EQ.2.OR.1.EQ.4) WRITE(6,65)
051. IF(1.EQ.1.OR.1.EQ.3) WRITE(6,69)
052. 562 CONTINUE
053. WRITE(6,65)
054. WRITE(6,848)
055. 848 FORMAT(' A4')
056. DO 565 I=1,5
057. DO 566 J=1,5
058. DO 567 K=1,5
059. WRITE(6,67) A4(I,J,K,1),A4(I,J,K,2),A4(I,J,K,3),A4(I,J,K,4)
060. 1,A4(I,J,K,5)
061. 567 CONTINUE
062. WRITE(6,68)
063. 566 CONTINUE
064. IF(1.EQ.2.OR.1.EQ.4) WRITE(6,65)
065. IF(1.EQ.1.OR.1.EQ.3) WRITE(6,69)
066. 565 CONTINUE
067. WRITE(6,65)
068. WRITE(6,849)
069. 849 FORMAT(' B4')
070. DO 568 I=1,5
071. DO 569 J=1,5
072. DO 570 K=1,5
073. WRITE(6,67) B4(I,J,K,1),B4(I,J,K,2),B4(I,J,K,3),B4(I,J,K,4)
074. 1,B4(I,J,K,5)
075. 570 CONTINUE
076. WRITE(6,68)
077. 569 CONTINUE
078. IF(1.EQ.2.OR.1.EQ.4) WRITE(6,65)
079. IF(1.EQ.1.OR.1.EQ.3) WRITE(6,69)
080. 568 CONTINUE
081. WRITE(6,65)
082. WRITE(6,850)
083. 850 FORMAT(' ')
084. 569 CONTINUE
085. IF(1.EQ.2.OR.1.EQ.4) WRITE(6,65)
086. IF(1.EQ.1.OR.1.EQ.3) WRITE(6,69)
087. 568 CONTINUE
088. WRITE(6,65)
089. WRITE(6,850)

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900.      850 FORMAT(' C4')
901.        DO 571 I=1,5
902.        DO 572 J=1,5
903.        DO 573 K=1,5
904.        WRITE(6,67) C4(I,J,K,1),C4(I,J,K,2),C4(I,J,K,3),C4(I,J,K,4)
905.        1,C4(I,J,K,5)
906.      573 CONTINUE
907.        WRITE(6,68)
908.      572 CONTINUE
909.        IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
910.        IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
911.      571 CONTINUE
912.        WRITE(6,65)
913.        WRITE(6,851)
914.      851 FORMAT(' D4')
915.        DO 574 I=1,5
916.        DO 575 J=1,5
917.        DO 576 K=1,5
918.        WRITE(6,67) D4(I,J,K,1),D4(I,J,K,2),D4(I,J,K,3),D4(I,J,K,4),
919.        1D4(I,J,K,5)
920.      576 CONTINUE
921.        WRITE(6,68)
922.      575 CONTINUE
923.        IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
924.        IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
925.      574 CONTINUE
926.        WRITE(6,65)
927.        WRITE(6,852)
928.      852 FORMAT(' E4')
929.        DO 577 I=1,5
930.        DO 578 J=1,5
931.        DO 579 K=1,5
932.        WRITE(6,67) E4(I,J,K,1),E4(I,J,K,2),E4(I,J,K,3),E4(I,J,K,4)
933.        1,E4(I,J,K,5)
934.      579 CONTINUE
935.        WRITE(6,68)
936.      578 CONTINUE
937.        IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
938.        IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
939.      577 CONTINUE
940.        WRITE(6,65)
941.        WRITE(6,853)
942.      853 FORMAT(' F4')
943.        DO 580 I=1,5
944.        DO 581 J=1,5
945.        DO 582 K=1,5
946.        WRITE(6,67) F4(I,J,K,1),F4(I,J,K,2),F4(I,J,K,3),F4(I,J,K,4)
947.        1,F4(I,J,K,5)
948.      582 CONTINUE
949.        WRITE(6,68)
950.      581 CONTINUE
951.        IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
952.        IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
953.      580 CONTINUE
954.        WRITE(6,65)
955.        WRITE(6,854)
956.      854 FORMAT(' G4')
957.        DO 583 I=1,5
958.        DO 584 J=1,5
959.        DO 585 K=1,5
960.        WRITE(6,67) G4(I,J,K,1),G4(I,J,K,2),G4(I,J,K,3),G4(I,J,K,4)
961.        1,G4(I,J,K,5)
962.      585 CONTINUE
963.        WRITE(6,68)
964.      584 CONTINUE
965.        IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
966.        IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
967.      583 CONTINUE
968.        WRITE(6,65)
969.        WRITE(6,855)
970.      855 FORMAT(' I4')
971.        DO 586 I=1,5
972.        DO 587 J=1,5
973.        DO 588 K=1,5
974.        WRITE(6,67) XI4(I,J,K,1),XI4(I,J,K,2),XI4(I,J,K,3)
975.        1,XI4(I,J,K,4),XI4(I,J,K,5)
976.      588 CONTINUE
977.        WRITE(6,68)
978.      587 CONTINUE
979.        IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
980.        IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
981.      586 CONTINUE

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982.      WRITE(6,65)
983.      WRITE(6,856)
984. 856  FORMAT(' L4')
985.      DO 589 I=1,5
986.      DO 590 J=1,5
987.      DO 591 K=1,5
988.      WRITE(6,67) XL4(I,J,K,1),XL4(I,J,K,2),XL4(I,J,K,3),XL4(I,J,K,4)
989. 1, XL4(I,J,K,5)
990. 591 CONTINUE
991.      WRITE(6,68)
992. 590 CONTINUE
993.      IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
994.      IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
995. 589 CONTINUE
996.      WRITE(6,65)
997.      WRITE(6,857)
998. 857  FORMAT(' Q4')
999.      DO 592 I=1,5
1000.      DO 593 J=1,5
1001.      DO 594 K=1,5
1002.      WRITE(6,67) Q4(I,J,K,1),Q4(I,J,K,2),Q4(I,J,K,3),Q4(I,J,K,4)
1003. 1, Q4(I,J,K,5)
1004. 594 CONTINUE
1005.      WRITE(6,68)
1006. 593 CONTINUE
1007.      IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
1008.      IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
1009. 592 CONTINUE
1010.      WRITE(6,65)
1011.      WRITE(6,858)
1012. 858  FORMAT(' R4')
1013.      DO 595 I=1,5
1014.      DO 596 J=1,5
1015.      DO 597 K=1,5
1016.      WRITE(6,67) R4(I,J,K,1),R4(I,J,K,2),R4(I,J,K,3),R4(I,J,K,4)
1017. 1, R4(I,J,K,5)
1018. 597 CONTINUE
1019.      WRITE(6,68)
1020. 596 CONTINUE
1021.      IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
1022.      IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
1023. 595 CONTINUE
1024.      WRITE(6,65)
1025.      WRITE(6,859)
1026. 859  FORMAT(' V4')
1027.      DO 598 I=1,5
1028.      DO 599 J=1,5
1029.      DO 600 K=1,5
1030.      WRITE(6,67) V4(I,J,K,1),V4(I,J,K,2),V4(I,J,K,3),V4(I,J,K,4)
1031. 1, V4(I,J,K,5)
1032. 600 CONTINUE
1033.      WRITE(6,68)
1034. 599 CONTINUE
1035.      IF(I.EQ.2.OR.I.EQ.4) WRITE(6,65)
1036.      IF(I.EQ.1.OR.I.EQ.3) WRITE(6,69)
1037. 598 CONTINUE
1038. 499  STOP
1039.      END
1040.      SUBROUTINE FC3(C3,I,J,K,L)
1041.      IMPLICIT REAL*8(A-H,O-Z)
1042.      DIMENSION C1(100),C2(100),C4(100)
1043.      CALL FISP(C1,I1,J)
1044.      CALL FIP(C2,I2,K)
1045.      CALL PMPY(C4,I3,C1,I1,C2,I2)
1046.      CALL FIP(C2,I2,L)
1047.      CALL PMPY(C1,I1,C2,I2,C4,I3)
1048.      CALL FIP(C2,I2,I)
1049.      CALL PMPY(C4,I3,C1,I1,C2,I2)
1050.      CALL FINT(C1,I1,C4,I3)
1051.      X=0.DO
1052.      DO 1 N=1,I1
1053.      X=X-C1(N)
1054. 1  CONTINUE
1055.      XX=((2*I-1)*(2*J-1)*(2*K-1)*(2*L-1)
1056.      IF(DABS(X).LT.1.D-7) X=0.DO
1057.      C3=X*DSQRT(XX)/2.DO
1058.      RETURN
1059.      END
1060.      SUBROUTINE FD3(D3,I,J,K,L)
1061.      IMPLICIT REAL*8(A-H,O-Z)
1062.      DIMENSION C1(100),C2(100),C3(100)
1063.      CALL FIPP(C1,I1,J)

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1064. CALL PA(C2,I2,1)
1065. CALL PMPY(C3,I3,C1,I1,C2,I2)
1066. CALL PDER(C1,I1,C3,I3)
1067. CALL FIP(C2,I2,1)
1068. CALL PMPY(C3,I3,C1,I1,C2,I2)
1069. CALL PINT(C1,I1,C3,I3)
1070. X=0.DO
1071. DO 1 N=1,I1
1072. X=X+C1(N)
1073. CONTINUE
1074. XX=(2*I-1)*(2*J-1)
1075. IF(DABS(X).LT.1.D-7) X=0.DO
1076. D3=3.DO*X*DSQRT(XX)/2.DO
1077. RETURN
1078. END
1079. SUBROUTINE FE3(E3,I,J,K,L)
1080. IMPLICIT REAL*8(A-H,O-Z)
1081. DIMENSION C1(100),C2(100),C3(100),C4(100)
1082. CALL FIP(C1,I1,K)
1083. CALL FIP(C2,I2,L)
1084. CALL PMPY(C3,I3,C1,I1,C2,I2)
1085. CALL PDER(C2,I2,C3,I3)
1086. CALL PDER(C1,I1,C2,I2)
1087. CALL FIP(C2,I2,1)
1088. CALL FIP(C3,I3,J)
1089. CALL PMPY(C4,I4,C2,I2,C3,I3)
1090. CALL PMPY(C2,I2,C1,I1,C4,I4)
1091. CALL PINT(C1,I1,C2,I2)
1092. X=0.DO
1093. DO 1 N=1,I1
1094. X=X-C1(N)
1095. CONTINUE
1096. XX=(2*I-1)*(2*J-1)*(2*K-1)*(2*L-1)
1097. IF(DABS(X).LT.1.D-7) X=0.DO
1098. E3=X*DSQRT(XX)
1099. RETURN
1100. END
1101. SUBROUTINE FF3(F3,I,J,K,L)
1102. IMPLICIT REAL*8(A-H,O-Z)
1103. DIMENSION C1(100),C2(100),C3(100)
1104. CALL FIP(C1,I1,K)
1105. CALL FIP(C2,I2,L)
1106. CALL PMPY(C3,I3,C1,I1,C2,I2)
1107. CALL FIPP(C2,I2,J)
1108. CALL PMPY(C1,I1,C2,I2,C3,I3)
1109. CALL PDER(C2,I2,C1,I1)
1110. CALL FIP(C3,I3,1)
1111. CALL PMPY(C1,I1,C2,I2,C3,I3)
1112. CALL PINT(C2,IINT,C1,I1)
1113. X=0.DO
1114. DO 1 N=1,IINT
1115. X=X-C2(N)
1116. CONTINUE
1117. XX=(2*I-1)*(2*J-1)*(2*K-1)*(2*L-1)
1118. IF(DABS(X).LT.1.D-7) X=0.DO
1119. F3=X*DSQRT(XX)
1120. RETURN
1121. END
1122. SUBROUTINE FG3(G3,I,J,K,L)
1123. IMPLICIT REAL*8(A-H,O-Z)
1124. DIMENSION C1(100),C2(100),C3(100)
1125. CALL FIP(C1,I1,I)
1126. CALL FIP(C2,I2,J)
1127. CALL PMPY(C3,I3,C1,I1,C2,I2)
1128. CALL PA(C2,I2,2)
1129. CALL PMPY(C1,I1,C2,I2,C3,I3)
1130. CALL PINT(C2,I2,C1,I1)
1131. X=0.DO
1132. DO 1 N=1,I2
1133. X=X-C2(N)
1134. CONTINUE
1135. XX=(2*I-1)*(2*J-1)
1136. IF(DABS(X).LT.1.D-7) X=0.DO
1137. G3=X*DSQRT(XX)
1138. RETURN
1139. END
1140. SUBROUTINE FH3(H3,I,J,K,L)
1141. IMPLICIT REAL*8(A-H,O-Z)
1142. DIMENSION C1(100),C2(100),C3(100),C4(100)
1143. CALL FIP(C1,I1,I)
1144. CALL FIP(C2,I2,J)
1145. CALL PMPY(C3,I3,C1,I1,C2,I2)
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1146. CALL PINT(C1,I1,C3,IJ)
1147. CALL FIP(C2,I2,K)
1148. CALL FIP(C4,I4,L)
1149. CALL FMPY(C3,I3,C4,I4,C2,I2)
1150. CALL FINT(C2,I2,C3,I3)
1151. CALL FMPY(C3,I3,C1,I1,C2,I2)
1152. CALL FINT(C1,I1,C3,I3)
1153. X=0.DO
1154. DO 1 N=1,I1
1155. X=X+C1(N)
1156. 1 CONTINUE
1157. XX=(2*I-1)*(2*J-1)*(2*K-1)*(2*L-1)
1158. IF(DABS(X).LT.1.D-7) X=0.DO
1159. H3=X*DSQRT(XX)
1160. RETURN
1161. END
1162. SUBROUTINE FI3(XI3,I,J,K,L)
1163. IMPLICIT REAL*8(A-H,O-Z)
1164. DIMENSION C1(100),C2(100),C3(100)
1165. CALL FIP(C1,I1,I)
1166. CALL FIP(C3,I3,J)
1167. CALL FMPY(C2,IJ,C1,I1,C3,I3)
1168. CALL FIP(C3,I3,K)
1169. CALL FMPY(C1,IJK,C3,I3,C2,IJ)
1170. CALL FIP(C3,I3,L)
1171. CALL FMPY(C2,IJL,C1,IJK,C3,I3)
1172. CALL PA(C3,IPA,1)
1173. CALL FMPY(C1,I1,C3,IPA,C2,IJKL)
1174. CALL FINT(C2,IINT,C1,I1)
1175. X=0.DO
1176. DO 1 N=1,IINT
1177. X=X-C2(N)
1178. 1 CONTINUE
1179. XX=(2*I-1)*(2*J-1)*(2*K-1)*(2*L-1)
1180. IF(DABS(X).LT.1.D-7) X=0.DO
1181. XI3=X*DSQRT(XX)
1182. RETURN
1183. END
1184. SUBROUTINE FJ3(XJ3,I,J,K,L)
1185. IMPLICIT REAL*8(A-H,O-Z)
1186. DIMENSION C1(100),C2(100),C3(100)
1187. CALL FIP(C1,I1,I)
1188. CALL FIP(C2,I2,J)
1189. CALL FMPY(C3,I3,C1,I1,C2,I2)
1190. CALL PA(C2,I2,3)
1191. CALL FMPY(C1,I1,C2,I2,C3,I3)
1192. CALL FINT(C2,I2,C1,I1)
1193. X=0.DO
1194. DO 1 N=1,I2
1195. X=X-C2(N)
1196. 1 CONTINUE
1197. XX=(2*I-1)*(2*J-1)
1198. IF(DABS(X).LT.1.D-7) X=0.DO
1199. XJ3=X*DSQRT(XX)
1200. RETURN
1201. END
1202. SUBROUTINE FO3(O3,I,J,K,L)
1203. IMPLICIT REAL*8(A-H,O-Z)
1204. DIMENSION C1(100),C2(100),C3(100)
1205. CALL FIP(C1,I1,J)
1206. CALL FIP(C2,I2,K)
1207. CALL FMPY(C3,I3,C1,I1,C2,I2)
1208. CALL PA(C2,I2,5)
1209. CALL FMPY(C1,I1,C2,I2,C3,I3)
1210. CALL FINT(C2,I2,C1,I1)
1211. X=0.DO
1212. DO 1 N=1,I2
1213. X=X+C2(N)
1214. 1 CONTINUE
1215. C2(1)=C2(1)-X
1216. CALL FIP(C3,I3,I)
1217. CALL FMPY(C1,I1,C2,I2,C3,I3)
1218. CALL FINT(C2,I2,C1,I1)
1219. X=0.DO
1220. DO 2 N=1,I2
1221. X=X-C2(N)
1222. 2 CONTINUE
1223. XX=(2*I-1)*(2*J-1)*(2*K-1)
1224. IF(DABS(X).LT.1.D-7) X=0.DO
1225. O3=X*DSQRT(XX)
1226. RETURN
1227. END
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1228. SUBROUTINE FQ3(Q3,I,J,K,L)
1229. IMPLICIT REAL*8(A-H,O-Z)
1230. DIMENSION C1(100),C2(100),C3(100)
1231. CALL FIP(C1,I1,K)
1232. CALL PA(C2,I2,5)
1233. CALL PMPY(C3,I3,C1,I1,C2,I2)
1234. CALL PINT(C1,I1,C3,I3)
1235. X=0.DO
1236. DO 1 N=1,I1
1237. X=X+C1(N)
1238. 1 CONTINUE
1239. C1(1)=C1(1)-X
1240. CALL FIP(C2,I2,J)
1241. CALL PMPY(C3,I3,C2,I2,C1,I1)
1242. CALL FIP(C2,I2,I)
1243. CALL PMPY(C1,I1,C2,I2,C3,I3)
1244. CALL PINT(C2,I2,C1,I1)
1245. X=0.DO
1246. DO 3 N=1,I2
1247. X=X-C2(N)
1248. 3 CONTINUE
1249. XX=(2*I-1)*(2*J-1)*(2*K-1)
1250. IF(DABS(X).LT.1.D-7) X=0.DO
1251. Q3=X*DSQRT(XX)
1252. RETURN
1253. END
1254. SUBROUTINE FS3(S3,I,J,K,L)
1255. IMPLICIT REAL*8(A-H,O-Z)
1256. DIMENSION C1(100),C2(100),C3(100)
1257. CALL FIP(C1,I1,I)
1258. CALL FIP(C2,J1,J)
1259. CALL PMPY(C3,IJ,C1,I1,C2,J1)
1260. CALL PINT(C2,I1,C3,IJ)
1261. CALL FI(C3,L)
1262. CALL PMPY(C1,IJL,C2,I1,C3,L)
1263. CALL FIP(C3,I1,K)
1264. CALL PMPY(C2,IJKL,C1,IJL,C3,I1)
1265. CALL PA(C3,IPA,4)
1266. CALL PMPY(C1,I1,C2,IJKL,C3,IPA)
1267. CALL PINT(C2,IINT,C1,I1)
1268. X=0.DO
1269. DO 1 N=1,IINT
1270. X=X+C2(N)
1271. 1 CONTINUE
1272. XX=(2*I-1)*(2*J-1)*(2*K-1)*(2*L-1)
1273. IF(DABS(X).LT.1.D-7) X=0.DO
1274. S3=X*DSQRT(XX)
1275. RETURN
1276. END
1277. SUBROUTINE FF4(F4,I,J,K,L)
1278. IMPLICIT REAL*8(A-H,O-Z)
1279. DIMENSION C1(100),C2(100),C3(100),C4(100)
1280. CALL FIP(C1,I1,J)
1281. CALL FI(C2,K)
1282. CALL PMPY(C3,JK,C1,I1,C2,K)
1283. CALL FI(C1,L)
1284. CALL PMPY(C2,JKL,C3,JK,C1,L)
1285. CALL PINT(C1,I1,C2,JKL)
1286. X=0.DO
1287. DO 1 N=1,I1
1288. X=X+C1(N)
1289. 1 CONTINUE
1290. C1(1)=C1(1)-X
1291. CALL FIP(C3,I3,I)
1292. CALL PMPY(C2,I2,C3,I3,C1,I1)
1293. CALL PINT(C3,I3,C2,I2)
1294. X=0.DO
1295. DO 2 N=1,I3
1296. X=X-C3(N)
1297. 2 CONTINUE
1298. XX=(2*I-1)*(2*J-1)*(2*K-1)*(2*L-1)
1299. IF(DABS(X).LT.1.D-7) X=0.DO
1300. F4=X*DSQRT(XX)
1301. RETURN
1302. END
1303. SUBROUTINE FG4(G4,I,J,K,L)
1304. IMPLICIT REAL*8(A-H,O-Z)
1305. DIMENSION C1(100),C2(100),C3(100)
1306. CALL FIP(C2,I2,K)
1307. CALL FIP(C1,I1,L)
1308. CALL PMPY(C3,KL,C1,I1,C2,I2)
1309. CALL FI(C1,J)
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1310. CALL PMPY(C2,JKL,C1,J,C3,KL)
1311. CALL PA(C1,IPA,4)
1312. CALL PMPY(C3,I3,C2,JKL,C1,IPA)
1313. CALL PINT(C1,I1,C3,I3)
1314. X=0.DO
1315. DO 1 N=1,I1
1316. X=X+C1(N)
1317. 1 CONTINUE
1318. C1(1)=C1(1)-X
1319. CALL FIP(C3,I3,I)
1320. CALL PMPY(C2,I2,C3,I3,C1,I1)
1321. CALL PINT(C3,I3,C2,I2)
1322. X=0.DO
1323. DO 2 N=1,I3
1324. X=X-C3(N)
1325. 2 CONTINUE
1326. XX=(2*I-1)*(2*J-1)*(2*K-1)*(2*L-1)
1327. IF(DABS(X).LT.1.D-7) X=0.DO
1328. G4=X*DSQRT(XX)
1329. RETURN
1330. END
1331. SUBROUTINE FL4(XL4,I,J,K,L)
1332. IMPLICIT REAL*8(A-H,O-Z)
1333. DIMENSION C1(100),C2(100),C3(100)
1334. CALL FIP(C1,IK,K)
1335. CALL FIP(C2,IL,L)
1336. CALL PMPY(C3,I1,C1,IK,C2,IL)
1337. CALL PINT(C1,IINT,C3,I1)
1338. CALL FI(C2,J)
1339. CALL PMPY(C3,I3,C2,J,C1,IINT)
1340. CALL PINT(C1,I1,C3,I3)
1341. X=0.DO
1342. DO 1 N=1,I1
1343. X=X+C1(N)
1344. 1 CONTINUE
1345. C1(1)=C1(1)-X
1346. CALL FIP(C2,I2,I)
1347. CALL PMPY(C3,I3,C2,I2,C1,I1)
1348. CALL PINT(C2,IINT,C3,I3)
1349. X=0.DO
1350. DO 2 N=1,IINT
1351. X=X-C2(N)
1352. 2 CONTINUE
1353. XX=(2*I-1)*(2*J-1)*(2*K-1)*(2*L-1)
1354. IF(DABS(X).LT.1.D-7) X=0.DO
1355. XL4=X*DSQRT(XX)
1356. RETURN
1357. END
1358. SUBROUTINE FM4(XM4,I,J,K,L)
1359. IMPLICIT REAL*8(A-H,O-Z)
1360. DIMENSION C1(100),C2(100),C3(100)
1361. CALL FI(C2,J)
1362. CALL PINT(C1,I1,C2,J)
1363. X=0.DO
1364. DO 1 N=1,I1
1365. X=X+C1(N)
1366. 1 CONTINUE
1367. C1(1)=C1(1)-X
1368. CALL PINT(C2,I2,C1,I1)
1369. CALL FI(C3,K)
1370. CALL PMPY(C1,I1,C2,I2,C3,K)
1371. CALL PINT(C2,I2,C1,I1)
1372. X=0.DO
1373. DO 2 N=1,I2
1374. X=X+C2(N)
1375. 2 CONTINUE
1376. C2(1)=C2(1)-X
1377. CALL FIP(C3,I3,I)
1378. CALL PMPY(C1,I1,C2,I2,C3,I3)
1379. CALL PINT(C2,I2,C1,I1)
1380. X=0.DO
1381. DO 3 N=1,I2
1382. X=X-C2(N)
1383. 3 CONTINUE
1384. XX=(2*I-1)*(2*J-1)*(2*K-1)
1385. IF(DABS(X).LT.1.D-7) X=0.DO
1386. XM4=X*DSQRT(XX)
1387. RETURN
1388. END
1389. SUBROUTINE FN4(XN4,I,J,K,L)
1390. IMPLICIT REAL*8(A-H,O-Z)
1391. DIMENSION C1(100),C2(100),C3(100)
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1392. CALL PA(C2,I2,I)
1393. CALL PINT(C1,I1,C2,I2)
1394. CALL FI(C2,J)
1395. CALL PMPY(C3,I3,C1,I1,C2,J)
1396. CALL PINT(C1,I1,C3,I3)
1397. X=0.DO
1398. DO 1 N=1,I1
1399. X=X+C1(N)
1400. 1 CONTINUE
1401. C1(1)=C1(1)-X
1402. CALL FIP(C2,I2,I)
1403. CALL PMPY(C3,I3,C1,I1,C2,I2)
1404. CALL PINT(C1,I1,C3,I3)
1405. X=0.DO
1406. DO 3 N=1,I1
1407. X=X-C1(N)
1408. 3 CONTINUE
1409. XX=(2*I-1)*(2*J-1)
1410. IF(DABS(X).LT.1.D-7) X=0.DO
1411. XN4=X*DSQRT(XX)
1412. RETURN
1413. END
1414. SUBROUTINE FQ4(Q4,I,J,K,L)
1415. IMPLICIT REAL*8(A-H,O-Z)
1416. DIMENSION C1(100),C2(100),C3(100),C4(100)
1417. CALL FIP(C2,ID1,I)
1418. CALL FIP(C3,ID2,J)
1419. CALL PMPY(C1,IP1,C2,ID1,C3,ID2)
1420. CALL FIP(C3,ID1,K)
1421. CALL FIPP(C2,ID3,L)
1422. CALL PMPY(C4,ID4,C3,ID1,C2,ID3)
1423. CALL PDER(C2,ID2,C4,ID4)
1424. CALL PMPY(C3,IP2,C2,ID2,C1,IP1)
1425. CALL PINT(C1,IINT,C3,IP2)
1426. X=0.DO
1427. DO 1 N=1,IINT
1428. X=X-C1(N)
1429. 1 CONTINUE
1430. XX=(2*I-1)*(2*J-1)*(2*K-1)*(2*L-1)
1431. IF(DABS(X).LT.1.D-7) X=0.DO
1432. Q4=X*DSQRT(XX)
1433. RETURN
1434. END
1435. SUBROUTINE FR4(R4,I,J,K,L)
1436. IMPLICIT REAL*8(A-H,O-Z)
1437. DIMENSION C1(100),C2(100),C3(100),C4(100)
1438. CALL FIP(C2,ID1,I)
1439. CALL FIP(C3,ID2,J)
1440. CALL PMPY(C1,IP1,C2,ID1,C3,ID2)
1441. CALL FIPP(C2,K2,K)
1442. CALL FIPP(C3,L2,L)
1443. CALL PMPY(C4,IP2,C2,K2,C3,L2)
1444. CALL PMPY(C2,IP,C1,IP1,C4,IP2)
1445. CALL PINT(C1,IINT,C2,IP)
1446. X=0.DO
1447. DO 1 N=1,IINT
1448. X=X-C1(N)
1449. 1 CONTINUE
1450. XX=(2*I-1)*(2*J-1)*(2*K-1)*(2*L-1)
1451. IF(DABS(X).LT.1.D-7) X=0.DO
1452. R4=X*DSQRT(XX)
1453. RETURN
1454. END
1455. SUBROUTINE FT4(T4,I,J,K,L)
1456. IMPLICIT REAL*8(A-H,O-Z)
1457. DIMENSION C1(100),C2(100),C3(100)
1458. CALL FI(C1,J)
1459. CALL PINT(C2,I2,C1,J)
1460. X=0.DO
1461. DO 1 N=1,I2
1462. X=X+C2(N)
1463. 1 CONTINUE
1464. C2(1)=C2(1)-X
1465. CALL PINT(C1,I1,C2,I2)
1466. CALL PA(C2,I2,4)
1467. CALL PMPY(C3,I3,C1,I1,C2,I2)
1468. CALL PINT(C1,I1,C3,I3)
1469. X=0.DO
1470. DO 2 N=1,I1
1471. X=X+C1(N)
1472. 2 CONTINUE
1473. C1(1)=C1(1)-X

```

```
1474. CALL FIP(C2,I2,I)
1475. CALL PMPY(C3,I3,C2,I2,C1,I1)
1476. CALL PINT(C2,I2,C3,I3)
1477. X=0.DO
1478. DO 3 N=1,I2
1479. X=X-C2(N)
1480. 3 CONTINUE
1481. XX=(2*I-1)*(2*J-1)
1482. IF(DABS(X).LT.1.D-7) X=0.DO
1483. T4=X*DSQRT(XX)
1484. RETURN
1485. END
1486. SUBROUTINE FU4(U4,I,J,K,L)
1487. IMPLICIT REAL*8(A-H,O-Z)
1488. DIMENSION C1(100),C2(100),C3(100)
1489. CALL FIP(C1,I1,I)
1490. CALL PA(C2,I2,4)
1491. CALL PMPY(C3,I3,C1,I1,C2,I2)
1492. CALL PINT(C1,I1,C3,I3)
1493. X=0.DO
1494. DO 1 N=1,I1
1495. X=X+C1(N)
1496. 1 CONTINUE
1497. XX=2*I-1
1498. IF(DABS(X).LT.1.D-7) X=0.DO
1499. U4=X*DSQRT(XX)/15.DO
1500. RETURN
1501. END
1502. SUBROUTINE FV4(V4,I,J,K,L)
1503. IMPLICIT REAL*8(A-H,O-Z)
1504. DIMENSION C1(100),C2(100),C3(100)
1505. CALL FIP(C1,I1,J)
1506. CALL FIP(C2,I2,K)
1507. CALL PMPY(C3,I3,C1,I1,C2,I2)
1508. CALL PINT(C1,I1,C3,I3)
1509. CALL FIP(C2,I2,L)
1510. CALL PMPY(C3,I3,C1,I1,C2,I2)
1511. CALL PA(C2,I2,4)
1512. CALL PMPY(C1,I1,C2,I2,C3,I3)
1513. CALL PINT(C2,I2,C1,I1)
1514. X=0.DO
1515. DO 1 N=1,I2
1516. X=X+C2(N)
1517. 1 CONTINUE
1518. C2(1)=C2(1)-X
1519. CALL FIP(C1,I1,I)
1520. CALL PMPY(C3,I3,C1,I1,C2,I2)
1521. CALL PINT(C1,I1,C3,I3)
1522. X=0.DO
1523. DO 2 N=1,I1
1524. X=X-C1(N)
1525. 2 CONTINUE
1526. XX=(2*I-1)*(2*J-1)*(2*K-1)*(2*L-1)
1527. IF(DABS(X).LT.1.D-7) X=0.DO
1528. V4=X*DSQRT(XX)
1529. RETURN
1530. END
1531. SUBROUTINE FW4(W4,I,J,K,L)
1532. IMPLICIT REAL*8(A-H,O-Z)
1533. DIMENSION C1(100),C2(100),C3(100)
1534. CALL FI(C1,J)
1535. CALL PINT(C2,I2,C1,J)
1536. X=0.DO
1537. DO 1 N=1,I2
1538. X=X+C2(N)
1539. 1 CONTINUE
1540. C2(1)=C2(1)-X
1541. CALL PINT(C1,I1,C2,I2)
1542. CALL PA(C2,I2,4)
1543. CALL PMPY(C3,I3,C1,I1,C2,I2)
1544. CALL FIP(C2,I2,K)
1545. CALL PMPY(C1,I1,C2,I2,C3,I3)
1546. CALL PINT(C2,I2,C1,I1)
1547. X=0.DO
1548. DO 2 N=1,I2
1549. X=X+C2(N)
1550. 2 CONTINUE
1551. C2(1)=C2(1)-X
1552. CALL FIP(C3,I3,I)
1553. CALL PMPY(C1,I1,C3,I3,C2,I2)
1554. CALL PINT(C2,I2,C1,I1)
1555. X=0.DO
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1556.      DO 3 N=1,12
1557.      X=X-C2(N)
1558.      CONTINUE
1559.      XX=(2*I-1)*(2*J-1)*(2*K-1)
1560.      IF(DABS(X).LT.1.D-7) X=0.DO
1561.      W4=X*DSQRT(XX)
1562.      RETURN
1563.      END
1564.
C *****
1565. C ***      SSP SUBROUTINES FMPY,PDER,PINT,PADDM      ***
1566.      SUBROUTINE FMPY(Z, IDIMZ, X, IDIMX, Y, IDIMY)
1567.      REAL*8 Z, X, Y
1568.      DIMENSION Z(1), X(1), Y(1)
1569.      IF(IDIMX*IDIMY) 10,10,20
1570.      10  IDIMZ=0
1571.      GO TO 50
1572.      20  IDIMZ=IDIMX+IDIMY-1
1573.      DO 30 I=1, IDIMZ
1574.      30  Z(I)=0.DO
1575.      DO 40 I=1, IDIMX
1576.      DO 40 J=1, IDIMY
1577.      K=I+J-1
1578.      40  Z(K)=X(I)*Y(J)+Z(K)
1579.      50  RETURN
1580.      END
1581.      SUBROUTINE PDER(Y, IDIMY, X, IDIMX)
1582.      REAL*8 Y, X, EXPT
1583.      DIMENSION X(1), Y(1)
1584.      IF(IDIMX-1) 3,3,1
1585.      1  IDIMY=IDIMX-1
1586.      EXPT=0.DO
1587.      DO 2 I=1, IDIMY
1588.      EXPT=EXPT+1.DO
1589.      2  Y(I)=X(I+1)*EXPT
1590.      GO TO 4
1591.      3  IDIMY=1
1592.      Y(1)=0.DO
1593.      4  RETURN
1594.      END
1595.      SUBROUTINE PINT(Y, IDIMY, X, IDIMX)
1596.      REAL*8 Y, X, EXPT
1597.      DIMENSION X(1), Y(1)
1598.      IDIMY=IDIMX+1
1599.      Y(1)=0.DO
1600.      IF(IDIMX) 1,1,2
1601.      1  RETURN
1602.      2  EXPT=1.DO
1603.      DO 3 I=2, IDIMY
1604.      Y(I)=X(I-1)/EXPT
1605.      3  EXPT=EXPT+1.DO
1606.      GO TO 1
1607.      END
1608.      SUBROUTINE PADDM(Z, IDIMZ, X, IDIMX, FACT, Y, IDIMY)
1609.      REAL*8 Z, X, FACT, Y
1610.      DIMENSION Z(1), X(1), Y(1)
1611.      NDIM=IDIMX
1612.      IF(IDIMX-IDIMY) 10,20,20
1613.      10  NDIM=IDIMY
1614.      20  IF(NDIM) 90,90,30
1615.      30  DO 80 I=1, NDIM
1616.      IF(I-IDIMX) 40,40,60
1617.      IF(I-IDIMY) 50,50,70
1618.      50  Z(I)=FACT*Y(I)+X(I)
1619.      GO TO 80
1620.      60  Z(I)=FACT*Y(I)
1621.      GO TO 80
1622.      70  Z(I)=X(I)
1623.      80  CONTINUE
1624.      IDIMZ=NDIM
1625.      RETURN
1626.      END
1627.
C *****
1628. C *****
1629.
1630.
1631.      **  OBJECTIVE OF SUBROUTINE SCINT : TO INTEGRATE, IN X, THE
1632.      FOLLOWING FUNCTION :
1633.      **  ^ SC(1)+SC(2).X +SC(3).X**2 + ...+ SC(ISC).X**(ISC-1)|.COS(A.X)
1634.      +^ SS(1)+SS(2).X +SS(3).X**2 + ...+ SS(ISS).X**(ISS-1)|.SIN(A.X)
1635.
1636.      SUBROUTINE SCINT(RCOS, ICOS, RSIN, ISIN, SC, ISC, SS, ISS, A)
1637.      IMPLICIT REAL*8(A-H, O-Z)

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ORIGINAL PAGE 10
OF POOR QUALITY

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1638.      DIMENSION RCOS(1),RSIN(1),SC(1),SS(1),AA(100)
1639.      1,A1(100),B1(100),AB(100)
1640.      AA(1)=0.DO
1641.      AB(1)=0.DO
1642.      IAA=1
1643.      IAB=1
1644.      ICOS=0
1645.      ISIN=0
1646.      IF(ISC.EQ.0) GO TO 20
1647.      DO 1 N=1,ISC
1648.      NN=N-1
1649.      CALL XMCAX(A1,IA1,B1,IB1,NN,A)
1650.      CALL PADDM(RCOS,ICOS,AA,IAA,SC(N),A1,IA1)
1651.      DO 2 M=1,ICOS
1652.      AA(M)=RCOS(M)
1653.      CONTINUE
1654.      2 IF(ICOS.GT.IAA) IAA=ICOS
1655.      CALL PADDM(RSIN,ISIN,AB,IAB,SC(N),B1,IB1)
1656.      DO 3 M=1,ISIN
1657.      AB(M)=RSIN(M)
1658.      CONTINUE
1659.      3 IF(ISIN.GT.IAB) IAB=ISIN
1660.      1 CONTINUE
1661.      DO 10 N=1,ICOS
1662.      AA(N)=RCOS(N)
1663.      10 CONTINUE
1664.      DO 11 N=1,ISIN
1665.      AB(N)=RSIN(N)
1666.      11 CONTINUE
1667.      20 IF(ISS.EQ.0) GO TO 21
1668.      DO 4 N=1,ISS
1669.      NN=N-1
1670.      CALL XMSAX(A1,IA1,B1,IB1,NN,A)
1671.      CALL PADDM(RCOS,ICOS,AA,IAA,SS(N),A1,IA1)
1672.      DO 5 M=1,ICOS
1673.      AA(M)=RCOS(M)
1674.      5 CONTINUE
1675.      IF(ICOS.GT.IAA) IAA=ICOS
1676.      CALL PADDM(RSIN,ISIN,AB,IAB,SS(N),B1,IB1)
1677.      DO 6 M=1,ISIN
1678.      AB(M)=RSIN(M)
1679.      6 CONTINUE
1680.      IF(ISIN.GT.IAB) IAB=ISIN
1681.      4 CONTINUE
1682.      ICOS=IAA
1683.      ISIN=IAB
1684.      21 RETURN
1685.      END
1686.      C *****
1687.      C ** SUBROUTINE XMSAX INTEGRATES (X**M).SIN(A.X) OVER X
1688.      C ** THE RESULT OF THE INDEFINITE INTEGRAL IS OF THE FORM :
1689.      C
1690.      C ^ A1(1)+A1(2).X + A1(3).X**2 + ...+A1(IA1).X**(IA1-1).COS(A.X)
1691.      C +^ B1(1)+B1(2).X + B1(3).X**2 + ...+B1(IB1).X**(IB1-1).SIN(A.X)
1692.      C
1693.      C ** THE COEFFICIENTS A1(I) AND B1(I) ARE DETERMINED BY XMSAX
1694.      C *****
1695.      C *****
1696.      C ANALYTICAL EXPRESSION FOR THE COEFFICIENTS A1 AND B1 :
1697.      C CRC TABLES, 26TH EDITION, PAGE 320, INTEGRAL NUMBER 392
1698.      C *****
1699.      C *****
1700.      C
1701.      C
1702.      C
1703.      SUBROUTINE XMSAX(A1,IA1,B1,IB1,M,A)
1704.      IMPLICIT REAL*8(A-H,O-Z)
1705.      DIMENSION C(100),A1(1),B1(1)
1706.      FACTM=1.DO
1707.      IF(M.LE.1) GO TO 25
1708.      DO 1 I=2,M
1709.      FACTM=FACTM*I
1710.      CONTINUE
1711.      1 IA1=M+1
1712.      DO 2 I=1,IA1
1713.      I1=I-1
1714.      FI1=1.DO
1715.      IF(I1.EQ.0) GO TO 33
1716.      DO 3 J=1,I1
1717.      FI1=FI1*J
1718.      CONTINUE
1719.      33 IXA=M+2-I

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1720.      XA=A**IXA
1721.      C(I)=FACTM/(FI1+XA)
1722. 2      CONTINUE
1723.      KK=-1
1724.      DO 4 I=1,IA1,2
1725.      J=IA1+1-I
1726.      A1(J)=KK*C(J)
1727.      IF(J.GT.1) A1(J-1)=0.DO
1728.      KK=-KK
1729. 4      CONTINUE
1730.      KK=1
1731.      IF(M.EQ.0) GO TO 6
1732.      DO 5 I=1,M,2
1733.      J=M+1-I
1734.      B1(J)=KK*C(J)
1735.      IF(J.GT.1) B1(J-1)=0.DO
1736.      KK=-KK
1737. 5      CONTINUE
1738. 6      IB1=M
1739.      RETURN
1740.      END
1741. C      *****
1742. C
1743. C      ** SUBROUTINE XMCAX INTEGRATES (X**M).COS(A.X) OVER X
1744. C
1745. C      ** THE RESULT OF THE INDEFINITE INTEGRAL IS OF THE FORM :
1746. C
1747. C      ^ A1(1)+A1(2).X + A1(3).X**2 + ...+A1(IA1).X**(IA1-1).COS(A.X)
1748. C      +^ B1(1)+B1(2).X + B1(3).X**2 + ...+B1(IB1).X**(IB1-1).SIN(A.X)
1749. C
1750. C      ** THE COEFFICIENTS A1(I) AND B1(I) ARE DETERMINED BY XMCAX
1751. C
1752. C      SUBROUTINE XMCAX(A1,IA1,B1,IB1,M,A)
1753. C      REAL*8 A1,B1,A
1754. C      DIMENSION A1(1),B1(1)
1755. C      CALL XMSAX(B1,IB1,A1,IA1,M,A)
1756. C      DO 1 N=1,IB1
1757. C      B1(N)=-B1(N)
1758. 1      CONTINUE
1759.      RETURN
1760.      END
1761. C      *****
1762. C
1763. C      *****
1764. C
1765. C      *** SUBROUTINES FI,FIP,FIPP AND FI3P, DEFINING THE SHIFTED
1766. C      LEGENDRE POLYNOMIALS AND THEIR FIRST, SECOND AND THIRD DERIVATIVES
1767. C
1768. C      SUBROUTINE FI(COEFF,I)
1769. C      REAL*8 COEFF
1770. C      DIMENSION COEFF(8)
1771. C      IF(I.EQ.1) GO TO 1
1772. C      IF(I.EQ.2) GO TO 2
1773. C      IF(I.EQ.3) GO TO 3
1774. C      IF(I.EQ.4) GO TO 4
1775. C      IF(I.EQ.5) GO TO 5
1776. C      IF(I.EQ.6) GO TO 6
1777. C      IF(I.EQ.7) GO TO 7
1778. C      COEFF(1)=-1.DO
1779. C      COEFF(2)=56.DO
1780. C      COEFF(3)=-756.DO
1781. C      COEFF(4)=4200.DO
1782. C      COEFF(5)=-11500.DO
1783. C      COEFF(6)=16632.DO
1784. C      COEFF(7)=-12012.DO
1785. C      COEFF(8)=3432.DO
1786. C      GO TO 50
1787. 7      COEFF(1)=1.DO
1788. C      COEFF(2)=-42.DO
1789. C      COEFF(3)=420.DO
1790. C      COEFF(4)=-1680.DO
1791. C      COEFF(5)=3150.DO
1792. C      COEFF(6)=-2772.DO
1793. C      COEFF(7)=924.DO
1794. C      GO TO 50
1795. 6      COEFF(1)=-1.DO
1796. C      COEFF(2)=30.DO
1797. C      COEFF(3)=-210.DO
1798. C      COEFF(4)=560.DO
1799. C      COEFF(5)=-630.DO
1800. C      COEFF(6)=252.DO
1801. C      GO TO 50
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1802.      5      COEFF(1)=1.DO
1803.          COEFF(2)=-20.DO
1804.          COEFF(3)=90.DO
1805.          COEFF(4)=-140.DO
1806.          COEFF(5)=70.DO
1807.          GO TO 50
1808.      4      COEFF(1)=-1.DO
1809.          COEFF(2)=12.DO
1810.          COEFF(3)=-30.DO
1811.          COEFF(4)=20.DO
1812.          GO TO 50
1813.      3      COEFF(1)=1.DO
1814.          COEFF(2)=-6.DO
1815.          COEFF(3)=6.DO
1816.          GO TO 50
1817.      2      COEFF(1)=-1.DO
1818.          COEFF(2)=2.DO
1819.          GO TO 50
1820.      1      COEFF(1)=1.DO
1821.      10     RETURN
1822.          END
1823.          SUBROUTINE FIP(COEFF,IP,I)
1824.              REAL*8 COEFF,C1
1825.              DIMENSION COEFF(100),C1(100)
1826.              CALL FI(C1,I)
1827.              CALL PDER(COEFF,IP,C1,I)
1828.              RETURN
1829.          END
1830.          SUBROUTINE FIPP(COEFF,IPP,I)
1831.              REAL*8 COEFF,C1
1832.              DIMENSION COEFF(100),C1(100)
1833.              CALL FI(COEFF,I)
1834.              CALL PDER(C1,IP,COEFF,I)
1835.              CALL PDER(COEFF,IPP,C1,IP)
1836.              RETURN
1837.          END
1838.          SUBROUTINE FI3P(COEFF,I3P,I)
1839.              REAL*8 COEFF,C1
1840.              DIMENSION COEFF(100),C1(100)
1841.              CALL FI(C1,I)
1842.              CALL PDER(COEFF,IP,C1,I)
1843.              CALL PDER(C1,IPP,COEFF,IP)
1844.              CALL PDER(COEFF,I3P,C1,IPP)
1845.              RETURN
1846.          END

```


** SUBROUTINE PA, DEFINING A FEW AUXILIARY POLYNOMIALS (X,X**2,ETC)

```

1853.          SUBROUTINE PA(COEFF,IPA,I)
1854.              REAL*8 COEFF
1855.              DIMENSION COEFF(6)
1856.              IF(I.EQ.1) GO TO 1
1857.              IF(I.EQ.2) GO TO 2
1858.              IF(I.EQ.3) GO TO 3
1859.              IF(I.EQ.4) GO TO 4
1860.              IF(I.EQ.5) GO TO 5
1861.              COEFF(1)=4.DO
1862.              COEFF(2)=0.DO
1863.              COEFF(3)=0.DO
1864.              COEFF(4)=-5.DO
1865.              COEFF(5)=0.DO
1866.              COEFF(6)=1.DO
1867.              IPA=6
1868.              GO TO 50
1869.      5      COEFF(1)=0.DO
1870.              COEFF(2)=0.DO
1871.              COEFF(3)=1.DO
1872.              IPA=3
1873.              GO TO 50
1874.      4      COEFF(1)=0.DO
1875.              COEFF(2)=1.DO
1876.              IPA=2
1877.              GO TO 50
1878.      3      COEFF(1)=1.DO
1879.              COEFF(2)=0.DO
1880.              COEFF(3)=-2.DO
1881.              COEFF(4)=0.DO
1882.              COEFF(5)=1.DO
1883.              IPA=5

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1884. GO TO 50
1885. COEFF(1)=5.DO
1886. COEFF(2)=0.DO
1887. COEFF(3)=-4.DO
1888. COEFF(4)=0.DO
1889. COEFF(5)=1.DO
1890. IPA=5
1891. GO TO 50
1892. COEFF(1)=1.DO
1893. COEFF(2)=0.DO
1894. COEFF(3)=-1.DO
1895. IPA=3
1896. 50 RETURN
1897. END

```

C
C
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C

** ADDITIONAL SUBROUTINES, USED TO EVALUATE THE COEFFICIENTS
INVOLVING PRODUCTS OF POLYNOMIALS AND TRIGONOMETRIC FUNCTIONS **

```

1904. SUBROUTINE FK(XK,I,J,K,L)
1905. IMPLICIT REAL*8(A-H,O-Z)
1906. DIMENSION C1(100),C2(100),C3(100),C4(100)
1907. COMMON PI
1908. A=(I-0.5D0)*PI
1909. CALL FISP(C1,I1,J)
1910. CALL FIP(C3,I3,K)
1911. CALL FMPY(C2,I2,C1,I1,C3,I3)
1912. CALL FIPP(C4,I4,J)
1913. CALL FMPY(C1,I1,C4,I4,C3,I3)
1914. IF(I1.NE.0) GO TO 10
1915. I1=1
1916. C1(1)=0.DO
1917. 10 DO 1 N=1,I1
1918. C1(N)=A*C1(N)
1919. 1 CONTINUE
1920. CALL SCINT(C3,I3,C4,I4,C1,I1,C2,I2,A)
1921. X=0.DO
1922. IF(I4.EQ.0) GO TO 11
1923. DO 2 N=1,I4
1924. X=X+C4(N)
1925. 2 CONTINUE
1926. 11 X=X*DSIN(A)-C3(1)
1927. IF(DABS(X).LT.1.D-7) X=0.DO
1928. XX=2*(2*J-1)*(2*K-1)
1929. XK=-X*DSQRT(XX)
1930. RETURN
1931. END
1932. SUBROUTINE FM(XM,I,J,K,L)
1933. IMPLICIT REAL*8(A-H,O-Z)
1934. DIMENSION C1(100),C2(100),C3(100),C4(100),AUX(2)
1935. COMMON PI
1936. A=(I-J)*PI
1937. CALL FA(C1,I1,4)
1938. ISS=1
1939. C2(1)=0.DO
1940. DO 1 IN=1,2
1941. IF(DABS(A).GT.1.D-2) GO TO 20
1942. AUX(IN)=0.5D0
1943. GO TO 3
1944. 20 X=0.DO
1945. CALL SCINT(C3,I3,C4,I4,C1,I1,C2,ISS,A)
1946. IF(I3.EQ.0) GO TO 10
1947. DO 2 N=1,I3
1948. X=X+C3(N)
1949. 2 CONTINUE
1950. 10 X=X*DCOS(A)-C3(1)
1951. AUX(IN)=X
1952. 3 A=(I+J-1)*PI
1953. 1 CONTINUE
1954. XM=AUX(1)-AUX(2)
1955. IF(DABS(XM).LT.1.D-7) XM=0.DO
1956. RETURN
1957. END
1958. SUBROUTINE FN(XN,I,J,K,L)
1959. IMPLICIT REAL*8(A-H,O-Z)
1960. DIMENSION C1(100),C2(100),C3(100),C4(100),AUX(2)
1961. COMMON PI
1962. A=(I-J)*PI
1963. CALL FA(C1,I1,1)
1964. ISS=1
1965. C2(1)=0.DO

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1966. DO 1 IN=1,2
1967. IF(DABS(A).GT.1.D-2) GO TO 20
1968. AUX(IN)=2.DO/3.DO
1969. GO TO 3
1970. 20 X=0.DO
1971. CALL SCINT(C3,I3,C4,I4,C1,I1,C2,ISS,A)
1972. IF(I3.EQ.0) GO TO 10
1973. DO 2 N=1,I3
1974. X=X+C3(N)
1975. 2 CONTINUE
1976. 10 X=X*DCOS(A)-C3(1)
1977. AUX(IN)=X
1978. 3 A=(I+J-1)*PI
1979. 1 CONTINUE
1980. XN=(I-0.5DO)*(J-0.5DO)*PI*PI*(AUX(1)+AUX(2))/2.DO
1981. IF(DABS(XN).LT.1.D-7) XN=0.DO
1982. RETURN
1983. END
1984. SUBROUTINE FR(R,I,J,K,L)
1985. IMPLICIT REAL*8(A-H,O-Z)
1986. DIMENSION C1(100),C2(100),C3(100),C4(100)
1987. COMMON PI
1988. A=(I-0.5DO)*PI
1989. CALL PA(C3,I3,4)
1990. CALL FIP(C2,I2,J)
1991. CALL PMPY(C1,I1,C2,I2,C3,I3)
1992. ISC=1
1993. C2(1)=0.DO
1994. CALL SCINT(C3,I3,C4,I4,C2,ISC,C1,I1,A)
1995. X=0.DO
1996. IF(I4.EQ.0) GO TO 10
1997. DO 1 N=1,I4
1998. X=X+C4(N)
1999. 1 CONTINUE
2000. 10 X=X*DSIN(A)-C3(1)
2001. IF(DABS(X).LT.1.D-7) X=0.DO
2002. XX=2*(2*J-1)
2003. R=X*DSQRT(XX)
2004. RETURN
2005. END
2006. SUBROUTINE A3F4(A3,I,J,K,L,IA3,IP4)
2007. IMPLICIT REAL*8(A-H,O-Z)
2008. DIMENSION C1(100),C2(100),C3(100),C4(100)
2009. COMMON PI
2010. A=(J-0.5DO)*PI
2011. CALL FIP(C1,I1,K)
2012. CALL FIP(C3,I3,I)
2013. CALL PMPY(C2,I2,C1,I1,C3,I3)
2014. CALL FIPP(C4,I4,K)
2015. CALL PMPY(C1,I1,C4,I4,C3,I3)
2016. IF(I1.NE.0) GO TO 10
2017. I1=1
2018. C1(1)=0.DO
2019. 10 DO 1 N=1,I1
2020. C1(N)=A*C1(N)
2021. 1 CONTINUE
2022. IF(I2.GE.1.AND.IP4.EQ.0) GO TO 20
2023. I2=1
2024. C2(1)=0.DO
2025. 20 DO 2 N=1,I2
2026. C2(N)=-A*A*C2(N)
2027. 2 CONTINUE
2028. CALL SCINT(C3,I3,C4,I4,C1,I1,C2,I2,A)
2029. X=0.DO
2030. IF(I4.EQ.0) GO TO 11
2031. DO 3 N=1,I4
2032. X=X+C4(N)
2033. 3 CONTINUE
2034. 11 X=X*DSIN(A)-C3(1)
2035. IF(DABS(X).LT.1.D-7) X=0.DO
2036. XX=2*(2*I-1)*(2*K-1)
2037. A3=-X*DSQRT(XX)
2038. RETURN
2039. END
2040. SUBROUTINE FB3(B3,I,J,K,L)
2041. IMPLICIT REAL*8(A-H,O-Z)
2042. DIMENSION C1(100),C2(100),C3(100),C4(100)
2043. COMMON PI
2044. B3=0.DO
2045. CALL FIP(C4,I4,I)
2046. CALL FIP(C3,I3,L)
2047. CALL PMPY(C1,I1,C3,I3,C4,I4)

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2048. CALL FIPP(C3,I3,L)
2049. CALL PMPY(C2,I2,C3,I3,C4,I4)
2050. IF(K.NE.J) GO TO 10
2051. CALL PINT(C3,I3,C1,I1)
2052. DO 1 N=1,I3
2053. B3=B3-C3(N)
2054. 1 CONTINUE
2055. A=-1.DO
2056. GO TO 20
2057. 10 A=(K-J)*PI
2058. DO 3 N=1,I2
2059. C2(N)=-A*C2(N)
2060. 3 CONTINUE
2061. CALL SCINT(C3,I3,C4,I4,C1,I1,C2,I2,A)
2062. IF(I3.EQ.0) GO TO 20
2063. DO 4 N=1,I3
2064. B3=B3+C3(N)
2065. 4 CONTINUE
2066. B3=1)-B3*DCOS(A)
2067. 20 K=K-1
2068. IF(K.NE.0) GO TO 30
2069. CALL PINT(C3,I3,C1,I1)
2070. DO 5 N=1,I3
2071. B3=B3+C3(N)
2072. 5 CONTINUE
2073. GO TO 40
2074. 30 AA=JK*PI
2075. DO 6 N=1,I2
2076. C2(N)=C2(N)*AA/A
2077. 6 CONTINUE
2078. CALL SCINT(C3,I3,C4,I4,C1,I1,C2,I2,AA)
2079. IF(I3.EQ.0) GO TO 40
2080. X=0.DO
2081. DO 7 N=1,I3
2082. X=X+C3(N)
2083. 7 CONTINUE
2084. B3=B3+X*DCOS(AA)-C3(1)
2085. 40 IF(DABS(B3).LT.1.D-7) B3=0.DO
2086. X=(2*I-1)*(2*L-1)
2087. B3=B3*DSQRT(X)
2088. RETURN
2089. END
2090. SUBROUTINE FR3(R3,I,J,K,L)
2091. IMPLICIT REAL*8(A-H,O-Z)
2092. DIMENSION C1(100),C2(100),C3(100),C4(100)
2093. COMMON PI
2094. A=(L-0.5DO)*PI
2095. CALL FIP(C3,I3,I)
2096. CALL FIP(C2,I2,J)
2097. CALL PMPY(C1,I1,C2,I2,C3,I3)
2098. CALL PINT(C2,I2,C1,I1)
2099. CALL FIP(C1,I1,K)
2100. CALL PMPY(C3,I3,C1,I1,C2,I2)
2101. CALL PA(C2,I2,5)
2102. CALL PMPY(C1,I1,C2,I2,C3,I3)
2103. ISC=1
2104. C2(1)=0.DO
2105. CALL SCINT(C3,I3,C4,I4,C2,ISC,C1,I1,A)
2106. X=0.DO
2107. IF(I4.EQ.0) GO TO 10
2108. DO 1 N=1,I4
2109. X=X+C4(N)
2110. 1 CONTINUE
2111. 10 X=X*DSIN(A)-C3(1)
2112. IF(DABS(X).LT.1.D-7) X=0.DO
2113. XX=2*(2*I-1)*(2*J-1)*(2*K-1)
2114. R3=X*DSQRT(XX)
2115. RETURN
2116. END
2117. SUBROUTINE U3D4(U3,I,J,K,L,UD3,UD4)
2118. IMPLICIT REAL*8(A-H,O-Z)
2119. DIMENSION C1(100),C2(100),C3(100),C4(100),C5(100)
2120. COMMON PI
2121. U3=0.DO
2122. XX=2.DO
2123. XA=1/2.DO-1/2
2124. IF(DABS(XA).GT.1.D-1) XX=0.DO
2125. IF(ID4.EQ.1) GO TO 1
2126. CALL PA(C1,I1,5)
2127. IAU3=J
2128. XXX=1.DO
2129. GO TO 2

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2130. 1 XXX=2*J-1
2131. CALL PA(C2,I2,4)
2132. CALL FI(C3,J)
2133. CALL PMPY(C1,I1,C2,I2,C3,J)
2134. IAUX=L
2135. 2 ISS=1
2136. C2(1)=0.DO
2137. IA=IAUX-K
2138. DO 3 IN=1,2
2139. IF(IA.NE.0) GO TO 10
2140. CALL PINT(C3,I3,C1,I1)
2141. X=0.DO
2142. DO 21 N=1,I3
2143. X=X+C3(N)
2144. 21 CONTINUE
2145. C3(1)=C3(I)-X
2146. CALL FIP(C5,I5,I)
2147. CALL PMPY(C4,I4,C3,I3,C5,I5)
2148. CALL PINT(C3,I3,C4,I4)
2149. X=0.DO
2150. DO 12 N=1,I3
2151. X=X+C3(N)
2152. 12 CONTINUE
2153. X=X-C3(1)
2154. U3=-U3+X
2155. GO TO 13
2156. 10 A=IA*PI
2157. CALL SCINT(C3,I3,C4,I4,C1,I1,C2,ISS,A)
2158. X=0.DO
2159. IF(I3.EQ.0) GO TO 20
2160. DO 4 N=1,I3
2161. X=X+C3(N)
2162. 4 CONTINUE
2163. 20 XA=DCOS(A)
2164. CONST=X*XA
2165. CALL FIP(C5,I5,I)
2166. CALL PMPY(C2,I2,C3,I3,C5,I5)
2167. CALL PMPY(C3,I3,C4,I4,C5,I5)
2168. CALL SCINT(C5,I5,C4,I4,C2,I2,C3,I3,A)
2169. X=0.DO
2170. IF(I5.EQ.0) GO TO 11
2171. DO 5 N=1,I5
2172. X=X+C5(N)
2173. 5 CONTINUE
2174. 11 U3=-U3+X*XA-C5(1)-CONST*XX
2175. C2(1)=0.DO
2176. 13 IA=IAUX+K-1
2177. 3 CONTINUE
2178. IF(DABS(U3).LT.1.D-7) U3=0.DO
2179. XX=(2*I-1)*XXX
2180. U3=U3*DSQRT(XX)
2181. RETURN
2182. END
2183. SUBROUTINE ACEI4(A4,I,J,K,L,IA4,IC4,IE4,II4)
2184. IMPLICIT REAL*8(A-H,O-Z)
2185. DIMENSION C1(100),C2(100),C3(100),C4(100)
2186. COMMON F1
2187. A=(L-0.5D0)*PI
2188. IF(IC4.EQ.1) GO TO 32
2189. IF(IE4.EQ.1) GO TO 33
2190. IF(II4.EQ.1) GO TO 34
2191. CALL FI(C1,J)
2192. CALL FIP(C2,I2,K)
2193. CALL PMPY(C3,I3,C1,J,C2,I2)
2194. CALL PA(C2,I2,4)
2195. GO TO 35
2196. 32 CALL FIP(C1,I1,J)
2197. CALL FIP(C2,I2,K)
2198. CALL PMPY(C3,I3,C1,I1,C2,I2)
2199. CALL PA(C2,I2,5)
2200. GO TO 35
2201. 33 CALL FI(C2,J)
2202. CALL FI(C3,K)
2203. I2=J
2204. I3=K
2205. GO TO 35
2206. 34 CALL FIP(C1,I1,J)
2207. CALL FIP(C2,I2,K)
2208. CALL PMPY(C3,I3,C1,I1,C2,I2)
2209. CALL PINT(C2,I2,C3,I3)
2210. CALL PA(C3,I3,4)
2211. 35 CALL PMPY(C1,I1,C2,I2,C3,I3)

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2212. ISC=1
2213. C4(1)=0.DO
2214. CALL SCINT(C2,I2,C3,I3,C4,ISC,C1,I1,A)
2215. X=0.DO
2216. IF(I3.EQ.0) GO TO 10
2217. DO 1 N=1,I3
2218. X=X+C3(N)
2219. CONTINUE
2220. 10 XX=DSIN(A)
2221. CONST=X*XX
2222. CALL FIP(C4,I4,I)
2223. CALL PMPY(C1,I1,C2,I2,C4,I4)
2224. CALL PMPY(C2,I2,C3,I3,C4,I4)
2225. CALL SCINT(C3,I3,C4,I4,C1,I1,C2,I2,A)
2226. X=0.DO
2227. IF(I4.EQ.0) GO TO 20
2228. DO 2 N=1,I4
2229. X=X+C4(N)
2230. 20 CONTINUE
2231. X=X*XX-C3(1)
2232. XX=2.DO
2233. XA=I/2.DO-I/2
2234. IF(DABS(XA).GE.1.D-1) XX=0.DO
2235. X=X-CONST*XX
2236. IF(DABS(X).LT.1.D-7) X=0.DO
2237. XX=2*(2*I-1)*(2*J-1)*(2*K-1)
2238. A4=-X*DSQRT(XX)
2239. RETURN
2240. END
2241. SUBROUTINE FB4(B4,I,J,K,L)
2242. IMPLICIT REAL*8(A-H,O-Z)
2243. DIMENSION C1(100),C2(100),C3(100),C4(100),C5(100)
2244. COMMON FI
2245. CALL FA(C2,I2,5)
2246. ISC=1
2247. C1(1)=0.DO
2248. AUX=L-0.5DO
2249. IAUX=1
2250. B4=0.DO
2251. CONST=0.DO
2252. IINT=1
2253. IA=J-K
2254. DO 1 I1=1,2
2255. DO 2 I2=1,2
2256. A=(IA+IAUX*AUX)*PI
2257. XA=DSIN(A)
2258. CALL SCINT(C3,I3,C4,I4,C1,ISC,C2,I2,A)
2259. X=0.DO
2260. IF(I4.EQ.0) GO TO 10
2261. DO 3 N=1,I4
2262. X=X+C4(N)
2263. 30 CONTINUE
2264. 10 CONST=CONST+IINT*X*XA
2265. CALL FIP(C5,I5,I)
2266. CALL PMPY(C1,I1,C3,I3,C5,I5)
2267. CALL PMPY(C3,I3,C4,I4,C5,I5)
2268. CALL SCINT(C4,I4,C5,I5,C1,I1,C3,I3,A)
2269. X=0.DO
2270. IF(I5.EQ.0) GO TO 11
2271. DO 4 N=1,I5
2272. X=X+C5(N)
2273. 40 CONTINUE
2274. 11 B4=B4-IINT*(X*XA-C4(1))
2275. IAUX=-IAUX
2276. IINT=-IINT
2277. C1(1)=0.DO
2278. 20 CONTINUE
2279. 2 IA=J+K-1
2280. IINT=-1
2281. 1 CONTINUE
2282. A=2.DO
2283. X=I/2.DO-I/2
2284. IF(DABS(X).GE.1.D-1) A=0.DO
2285. X=2*I-1
2286. B4=(B4+A*CONST)*DSQRT(X/2.DO)
2287. RETURN
2288. END
2289. SUBROUTINE J4K4(XJ4,I,J,K,L,IJ4,IK4)
2290. IMPLICIT REAL*8(A-H,O-Z)
2291. DIMENSION C1(100),C2(100),C3(100),C4(100)
2292. COMMON FI
2293. IF(IK4.EQ.1) GO TO 10

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2294. A=(K-0.5D0)*PI
2295. CALL FI(C2,J)
2296. CALL PINT(C1,I1,C2,J)
2297. X=0.DO
2298. DO 1 N=1,I1
2299. X=X+C1(N)
2300. 1 CONTINUE
2301. C1(1)=C1(1)-X
2302. CALL PINT(C2,I2,C1,I1)
2303. XXX=2*J-1
2304. GO TO 11
2305. 10 A=(J-0.5D0)*PI
2306. CALL FA(C1,I1,1)
2307. CALL PINT(C2,I2,C1,I1)
2308. XXX=1.DO
2309. 11 CALL FA(C3,I3,4)
2310. CALL PMPY(C1,I1,C2,I2,C3,I3)
2311. ISC=1
2312. C4(1)=0.DO
2313. CALL SCINT(C2,I2,C3,I3,C4,ISC,C1,I1,A)
2314. X=0.DO
2315. IF(I3.EQ.0) GO TO 12
2316. DO 2 N=1,I3
2317. X=X+C3(N)
2318. 2 CONTINUE
2319. 12 XX=DSIN(A)
2320. CONST=X*XX
2321. CALL FIP(C4,I4,I)
2322. CALL PMPY(C1,I1,C2,I2,C4,I4)
2323. CALL PMPY(C2,I2,C3,I3,C4,I4)
2324. CALL SCINT(C3,I3,C4,I4,C1,I1,C2,I2,A)
2325. X=0.DO
2326. IF(I4.EQ.0) GO TO 13
2327. DO 3 N=1,I4
2328. X=X+C4(N)
2329. 3 CONTINUE
2330. 13 X=X*XX-C3(1)
2331. XX=2.DO
2332. XA=I/2.DO-I/2
2333. IF(DABS(XA).GE.1.D-1) XX=0.DO
2334. X=X-CONST*XX
2335. IF(DABS(X).LT.1.D-7) X=0.DO
2336. XX=2*(2*I-1)*XXX
2337. XJ4=-X*DSQRT(XX)
2338. RETURN
2339. END
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